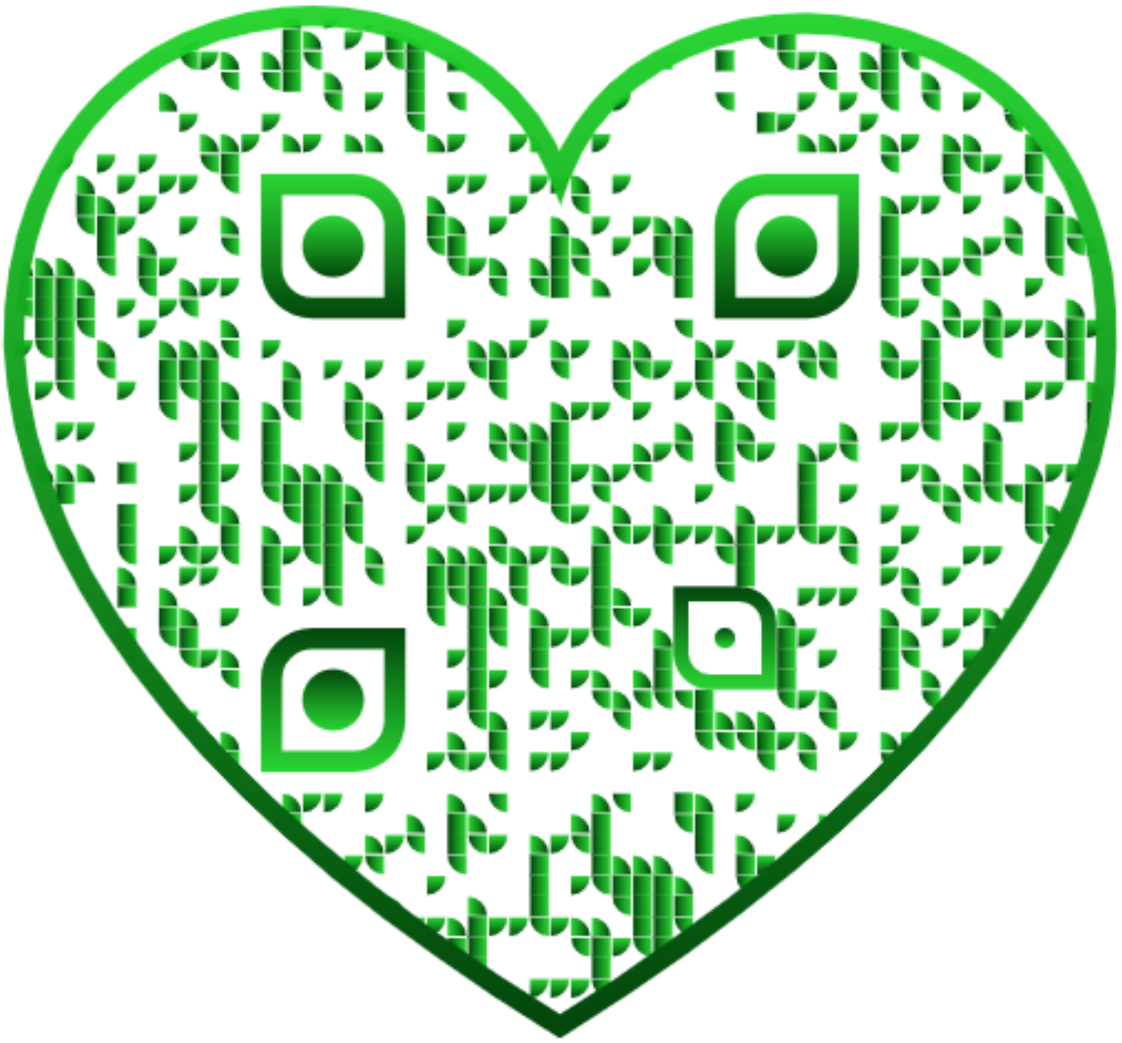
QUSHAISH'S COLLECTIONS

PRACTICAL OPHTHALMOLOGY



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EYE ANATOMY & ITS BLOOD SUPPLY

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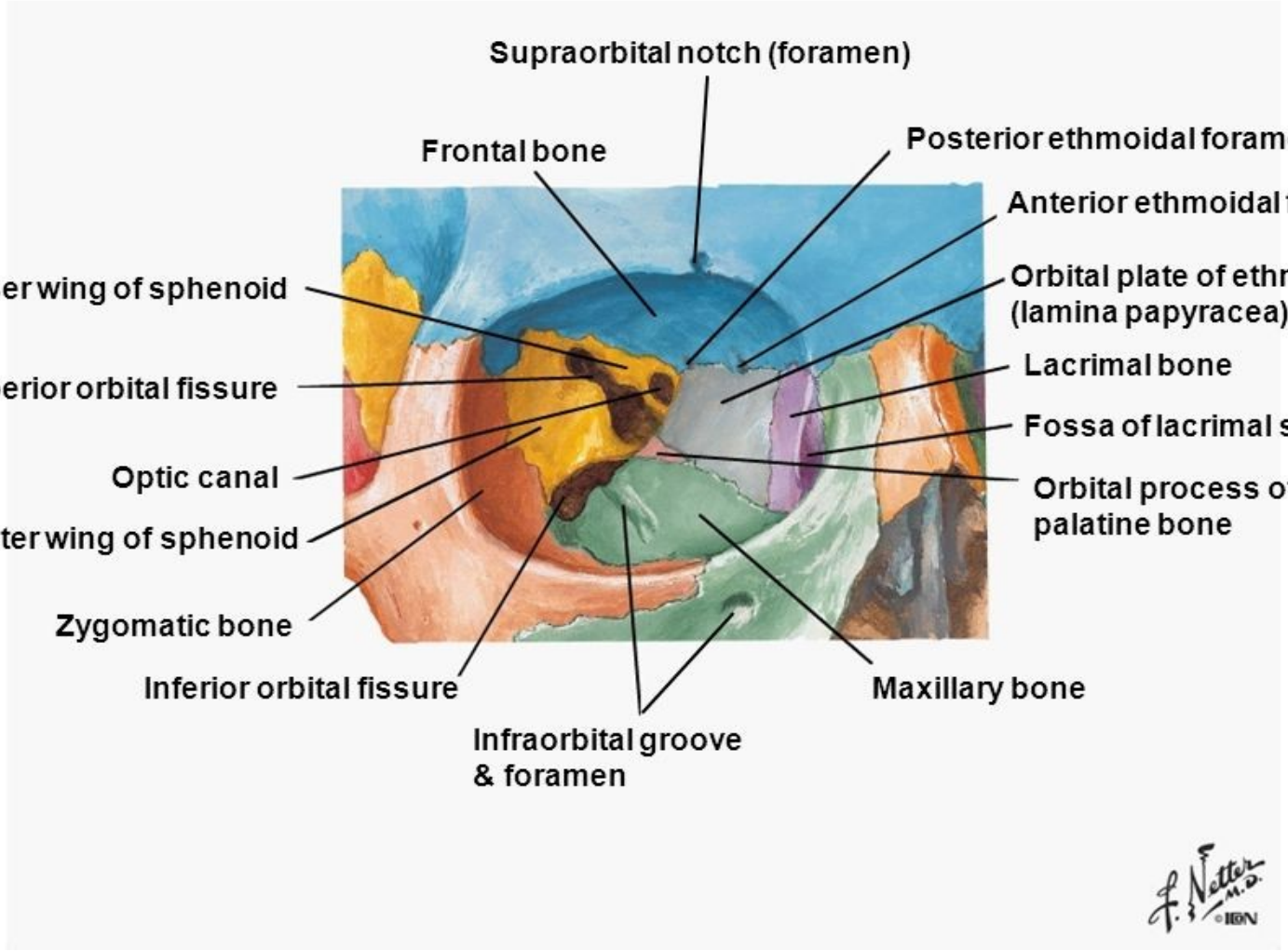
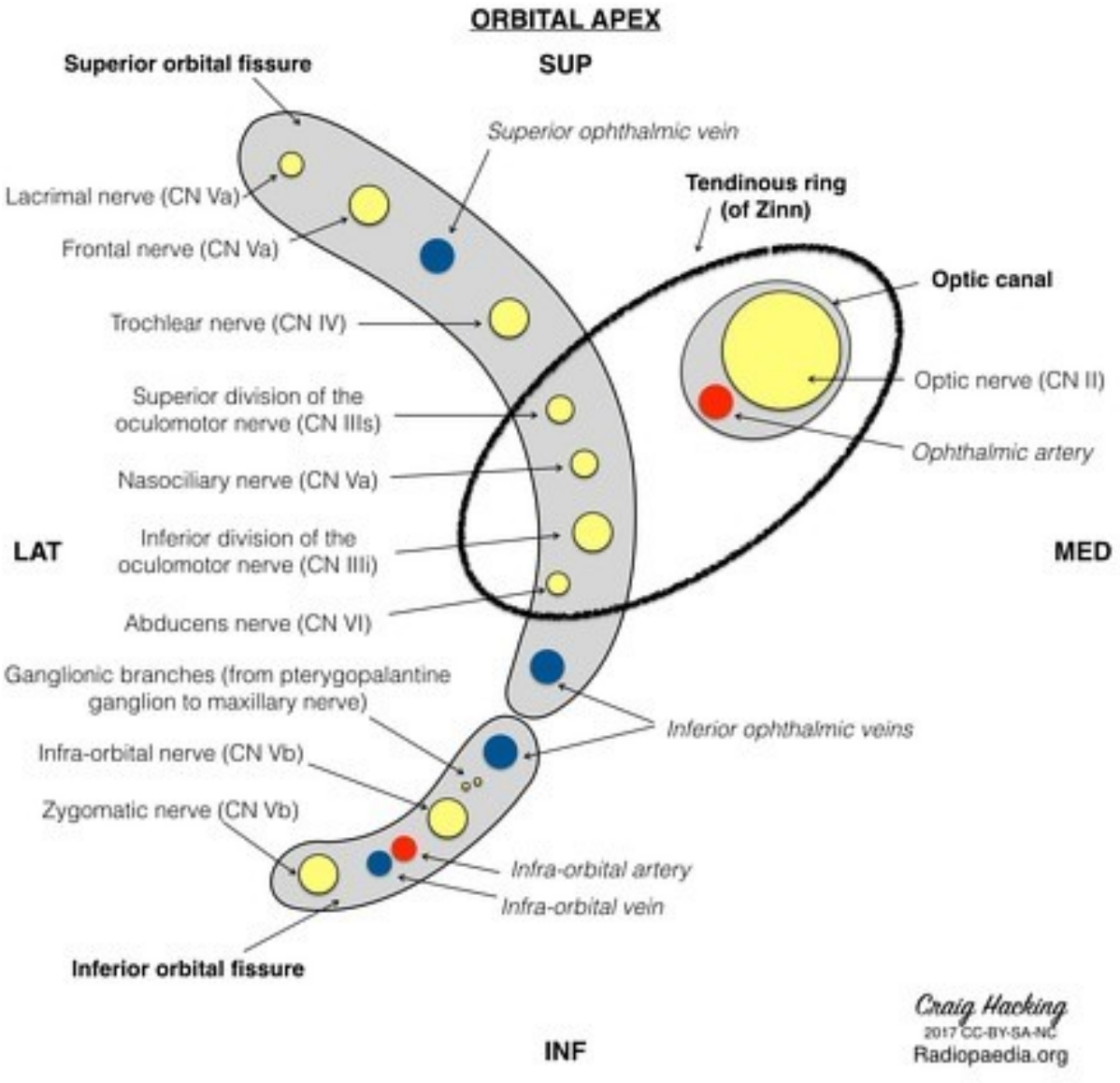
RIGHT BONY ORBIT (ANTERIOR VIEW)




ORBITAL APEX
Superior orbital fissure
SUP
Superior ophthalmic vein
Tendinous ring
(of Zinn)
Lacrimal nerve (CN Va)
Frontal nerve (CN Va)
Optic canal
Trochlear nerve (CN IV)
Optic nerve (CN II)
Superior division of the
oculomotor nerve (CN IIIs)
Ophthalmic artery
Nasociliary nerve (CN Va)
LAT
Inferior division of the
oculomotor nerve (CN IIIi)
MED
Abducens nerve (CN VI)
Ganglionic branches (from pterygopalantine
ganglion to maxillary nerve)
Inferior ophthalmic veins
Infra-orbital nerve (CN Vb)
Zygomatic nerve (CN Vb)
Infra-orbital artery
Infra-orbital vein
Inferior orbital fissure
INF
Craig Hacking
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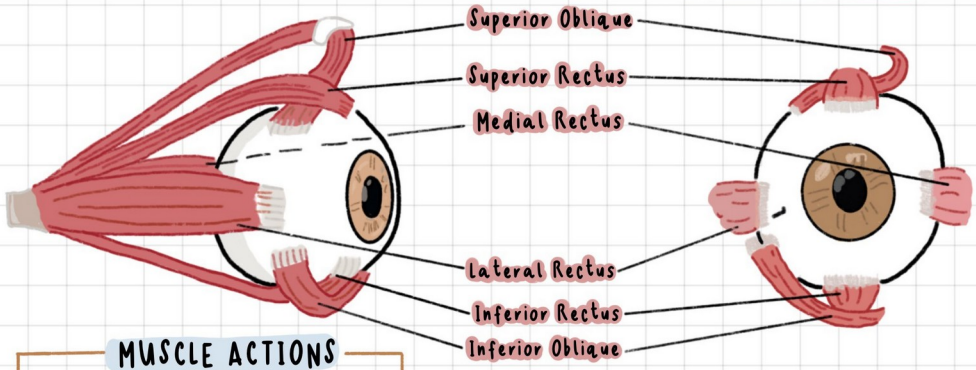
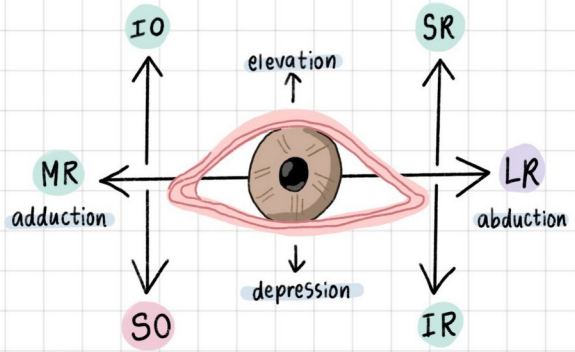
Radiopaedia.org

Extraocular Muscles



MUSCLE ACTIONS

	PRIMARY	SECONDARY	TERTIARY
LR	abduction	—	—
MR	adduction	—	—
SR	elevation	intorsion	add.
IR	depression	extorsion	add.
IO	extorsion	elevation	abd.
SO	intorsion	depression	abd.



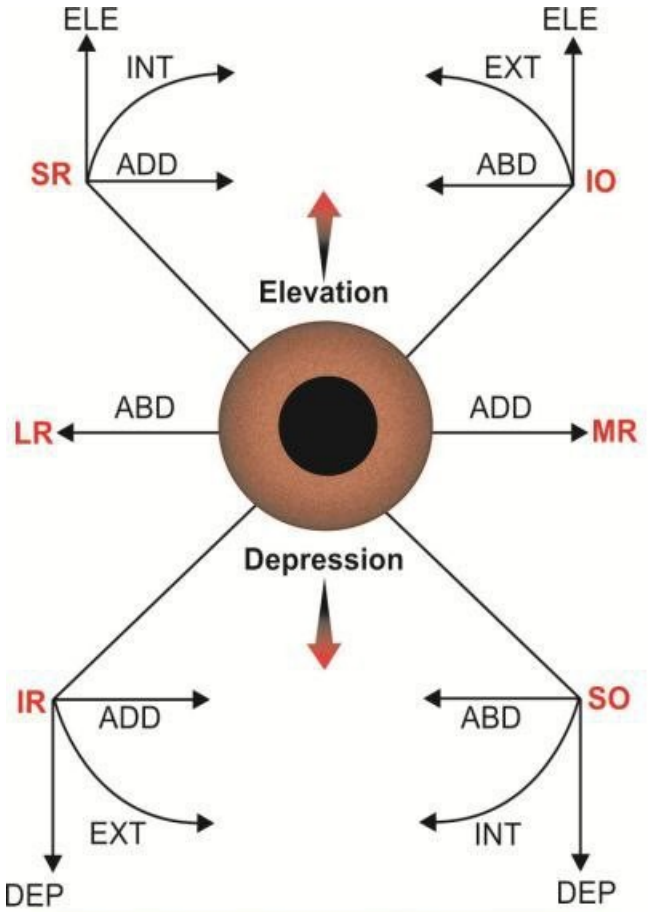
INNERVATIONS

- CN3 - oculomotor nerve
- CN4 - trochlear nerve
- CN6 - abducens nerve

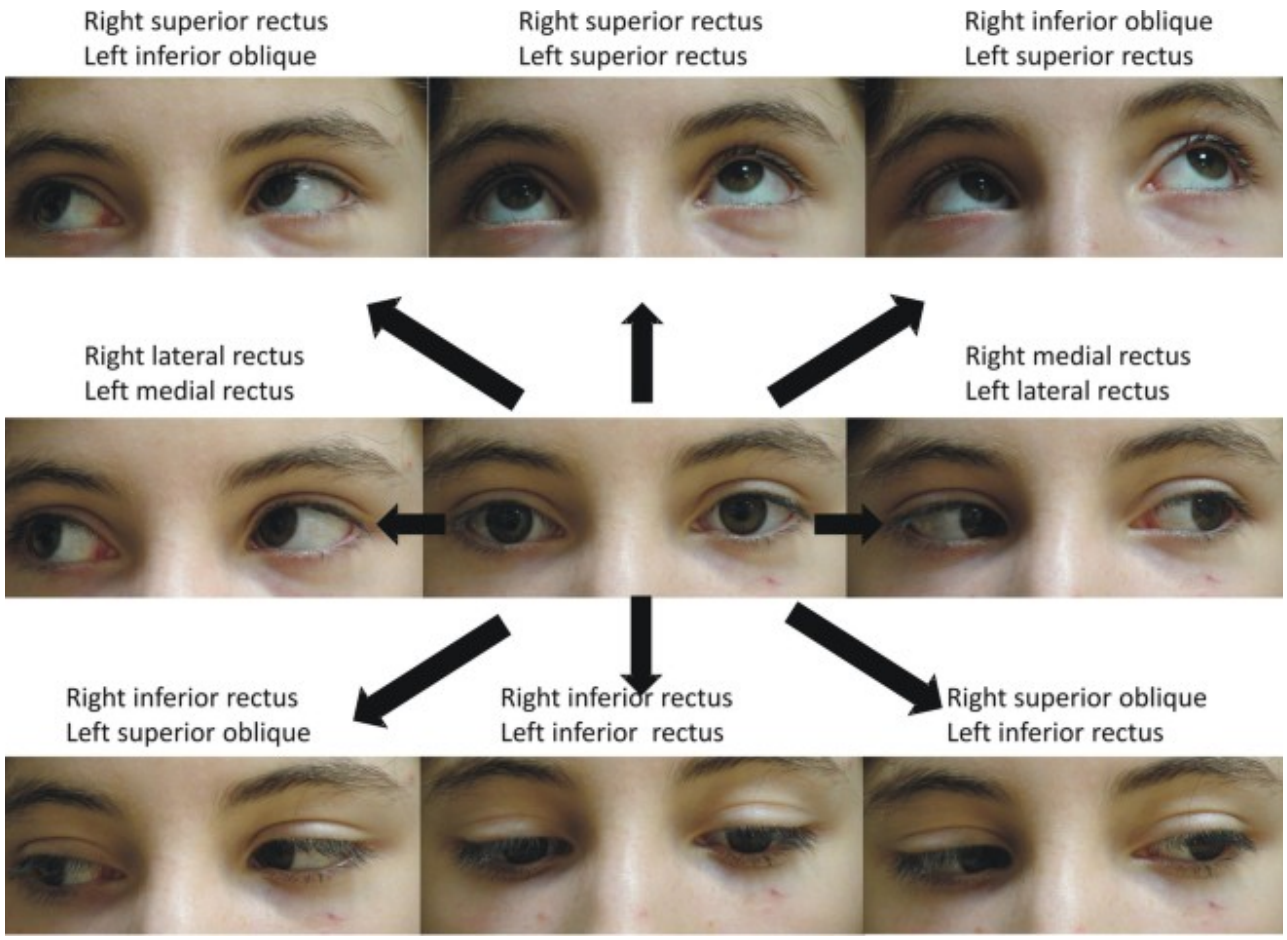
MNEMONIC: "LR6 - SO4 - R3"

- Lateral Rectus is 6th CN
- Superior Oblique is 4th CN
- Rest are all 3rd CN

@PTflashcards @PTflashcards



MR	= Medial rectus	INT	= Introsion
LR	= Lateral rectus	EXT	= Extorsion
SR	= Superior rectus	ADD	= Adduction
IR	= Inferior rectus	ABD	= Abduction
SO	= Superior oblique	ELE	= Elevation
IO	= Inferior oblique	DEP	= Depression


Right superior rectus
Left inferior oblique
Right superior rectus
Left superior rectus
Right inferior oblique
Left superior rectus
Right lateral rectus
Left medial rectus
Right medial rectus
Left lateral rectus
Right inferior rectus
Left superior oblique
Right inferior rectus
Left inferior rectus
Right superior oblique
Left inferior rectus

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Anatomy of the eye

❖ Coats of the eyeball:

Composed of:

1- Outer (Protective)(Fibrous) layer: Cornea + Sclera

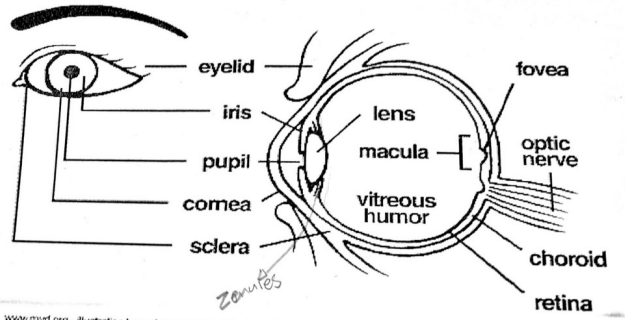
- It is a dense strong wall which protects the intraocular contents.
- **Anterior 1/6** of this fibrous coat is **transparent** and is called **cornea**.
- **Posterior 5/6** of this fibrous coat is **opaque** part is called **sclera**.
- **Cornea** is set into sclera like a **watch glass**.
- **Junction** of the cornea and sclera is called **limbus**.

2- Middle (Nutritive) (Uveal tract) layer:

- It supplies **nutrition** to the various structures of the eyeball.
- It consists of 3 parts which from **anterior** to posterior are: **iris**, **ciliary body** and **choroid**.

3- Inner (Nervous) layer: Retina

- It is concerned with visual functions.



www.nwf.org - illustration based upon information from National Eye Institute / National Institutes of Health

❖ Contents of the eye:

1- Anterior chamber (A/C)

- It is bounded anteriorly by **Cornea**, and posteriorly by **Iris**
- The anterior chamber is about **(2 -3) mm depth** in the centre in normal adults.
- It contains about **0.25 ml** of the **aqueous humour**.

2- Posterior chamber (P/C)

- It contains about **0.06 ml** of **aqueous humour**
- It is bounded anteriorly by the of **iris**, posteriorly by the crystalline **lens** and its **zonules**.

3- Vitreous Cavity

- located between the **Crystalline lens** and the **retina.**

4- Crystalline lens:

- between the **iris** and the **vitreous**
- suspended by **zonule of zinn** ((Suspensory ligament))

NOTE:

- Anterior chamber & posterior chamber filled with **Aqueous humor.**
- Vitreous cavity filled with **Vitreous humor**

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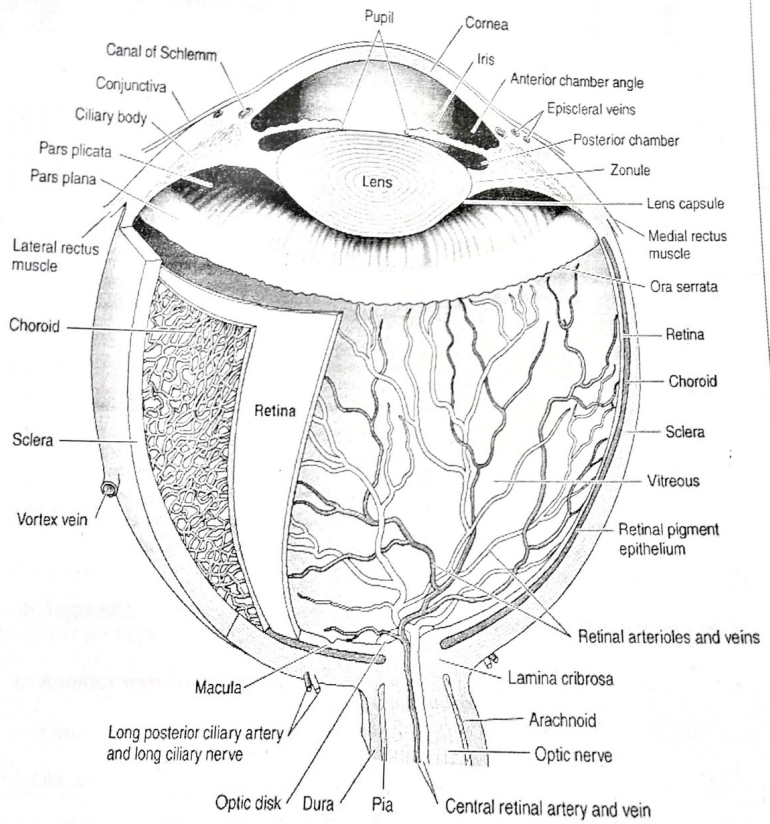
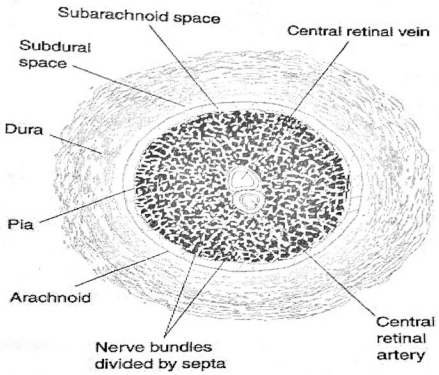


Optic Nerve

2nd cranial nerve .....Characterized by

- Only cranial cover by meninges
- Only cranial nerve inside it blood vessels
  (CRA = Central retinal artery), (CRV = Central retinal vein)
- The optic nerve consists of about (1 - 1.5) million axons. axons



❖ Segments of the eyeball

The eyeball can be divided into two segments: anterior and posterior.

1. Anterior segment.

   It ***includes lens*** and ***structures anterior*** to **it**,

   (like iris, cornea and two aqueous humour-filled spaces : anterior and posterior chambers)

2. Posterior segment

   It includes the ***structures posterior*** to **lens**,

   (Like vitreous humour, retina, choroid and optic disc)

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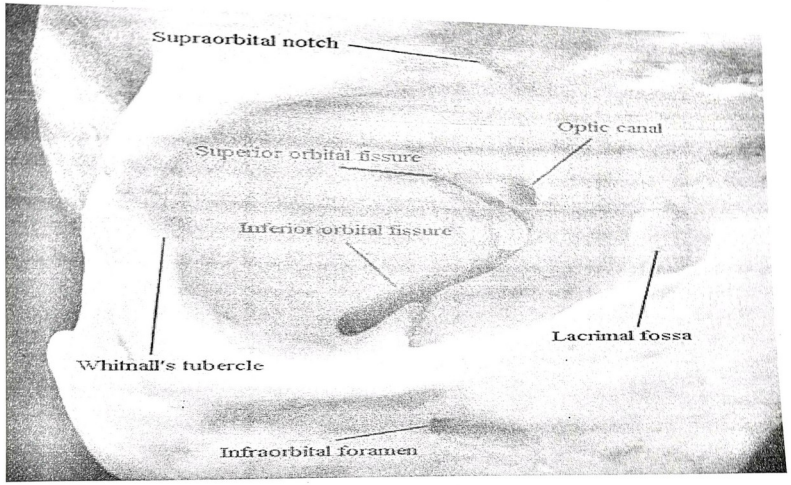
❖ Accessory structures related to the eyeball:

1- Eyelid
2- Lacrimal apparatus
3- Orbit

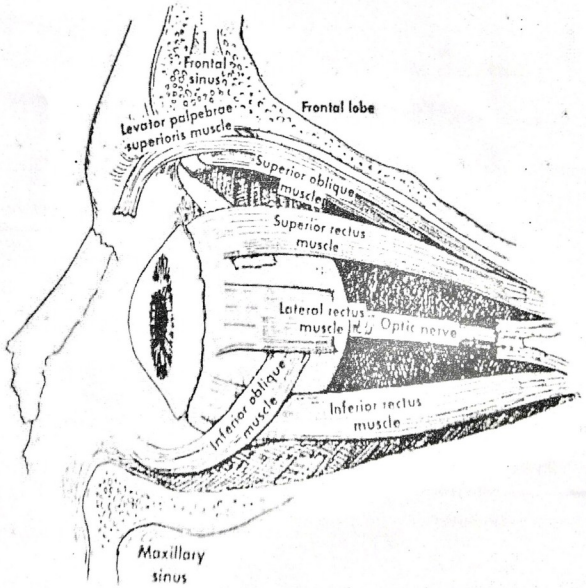


4- Conjunctiva

Orbital opening	Structure
Superior orbital fissure *(3456V)*	1-Superior & Inferior division of **Oculomotor** .N(3) 2-**Trochlear** .N (4) 3-**Abducent** .N (6) (5) 4-Three branches of ophthalmic branch of **Trigeminal** nerve (Lacrimal, Frontal ,Nasociliary) 5- Ophthalmic **veins** (superior & inferior branches)
Inferior orbital fissure *(N & A)*	1-Maxillary branch of Trigeminal nerve & it's terminal branches (zygomatic nerve , infra-orbital nerve) 2-Infra-orbital artery
Optic Canal *(2O)*	1- Optic Nerve 2- Ophthalmic artery

- Extra-ocular muscle (6)

4 Recti	2 Oblique
Medial rectus (MR)	Superior Oblique (SO)
Lateral rectus (LR)	Inferior Oblique (IO)
Superior rectus (SR)	
Inferior rectus (IR)	



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❖ Diameter & physical properties of globe

- Anterioposterior diameter (Axial length) = 24mm
- Horizontal diameter = 23.5mm
- Vertical diameter = 23mm
- Circumference = 75 mm
- Volume = 6.5 ml
- Weight = 7 gm

❖ Blood supply of the eyeball:

- **Arterial:** ophthalmic artery which's originated from the internal carotid artery
- **Venous:** ophthalmic vein which's drainage to the cavernous sinus.

❖ Lymphatic drainage of eye

Lateral 2/3 = drainage to pre-auricular L.N

Medial 1/3 = drainage to Sub-maxillary & Sub-mandibular L.N

Both at last drainage to Deep Cervical L.N

■ The intraocular pressure (IOP)

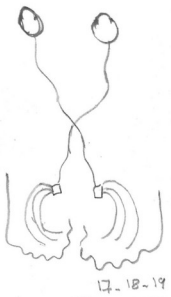
- *The pressure within the eye is maintained by continuous formation & drainage of aqueous humor*
- *Aqueous is secreted by the Ciliary body → posterior chamber → Pupil → anterior chamber → drained through the angle of anterior chamber.*
- *The intraocular pressure, (IOP), is normally 10 – 21 mmHg*

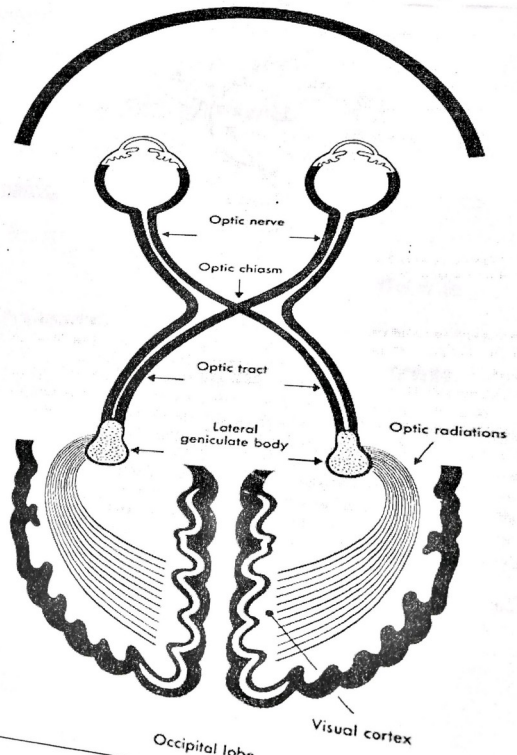
❖ *Eye at birth*

- *Eyeball is about 70% of adult length, fully developed at age of 6 years*
- *cornea is about 80% of adult length, fully developed at age of 2 years*

❖ Visual pathway

1- Optic nerves
2- Optic chiasm
3- Optic tracts
4- Lateral geniculate bodies
5- Optic radiations
6- Visual Cortex (17, 18, 19)





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❖ Nerve supply of eye:

1- Sensory: Ophthalmic branch of 5th cranial nerve (Trigeminal)

(NO PAIN supply to Lens, vitreous, choroid, retina)

2- Motor:

3rd CN (Oculomotor) supply **SR, IR, MR, IO, LEVATOR SUPERIORS** of eyelid

4th CN (Trochlear) supply **SO**

6th CN (Abducent) supply **LR**

7th CN (Facial) supply **ORBICULARIS OCULI** of eyelid

3- Autonomic:

Sympathetic ::- (Superior cervical ganglion)

DILATOR PAPILLAE MS, MULLER'S MS of eyelid

Parasympathetic ::- (Ciliary ganglion)

SPHINCTER PAPILLAE MS, CILIARY MUSCLES

All Extraocular muscles supplied by Oculomotor .N EXCEPT (LR6, SO4)

All Intraocular muscles supplied by Parasympathetic EXCEPT (Dilator papillae by Sympathetic)

Embryology of the eye

Surface Ectoderm	1-Lens 2-Eyelid (eyelashes, skin, gland) 3-Eye brow 4-Epithelium of (cornea, conjunctiva, lacrimal app)
Neural ectoderm	1- Optic nerve 2- Retina 3- Zonule of lens 4- Epithelium of: iris, ciliary body 5- Sphincter& dilator papillae
Mesoderm	1- Extra ocular Ms 2- Sheaths of optic nerve 3- Vitreous 4- Choroid 5- Stroma of: cornea, iris, ciliary stroma 6- Ciliary Ms 7- BVs of the eye 8- Sclera 9- Bony orbit 10- Connective tissue of conjunctiva & lacrimal app

لا تنسونا من صالح الدعاء

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Refractive media (Ocular media)

- **Refractive media: -** it's structures in which light pass.

Consist from

- Cornea
- Aqueous Humor
- Lens
- Vitreous Humor

Refractive Index

- Cornea = 1.37
- Aqueous humor = 1.33
- Lens = 1. 40
- Vitreous humor = 1.33

- All refractive medias are **TRANSPARENT**
  1. All refractive medias are **AVASCULAR**
  2. **NO NERVE SUPPLY** in all refractive medias (**EXCEPT CORNEA**)

parallel rays come to focus on the retina when the eye at rest (without accommodation)

Emmetropia

Refractive power

- **Myopia**

parallel rays come to focus in front retina when the eye at rest (without accommodation)

- **Hypermetropia**

parallel rays come to focus behind retina when the eye at rest (without accommodation)

- **Astigmatism**

parallel rays do not come to point focus (without accommodation)

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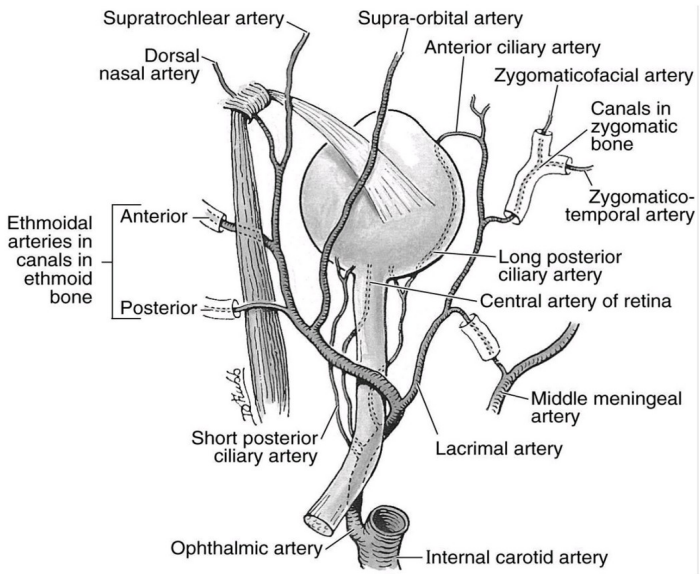
Blood Supply Of The Globe (Mainly By "*Ophthalmic Artery*")



✓ This branch of the internal carotid artery inter the orbit via optic canal within the dural sheath of the optic nerve. It supply the contents of the orbit.

★ **Ocular group:**

- Long ciliary artery, 2 long posterior ciliary arteries, one on each side of the eyeball, run between the sclera and choroid to anastomasose with anterior ciliary arteries, which are derived from muscular branches.
- Short ciliary artery.
- Anterior ciliary artery.
- Central retinal artery to the retina (inner layer) and optic nerve, is an end artery.
- Muscular artery to extraocular muscular.

★ **Orbital group:**

- Lacrimal artery to the lacrimal gland and eyelid.
- Supraorbital & supratrochlear arteries to the forehead.
- Posterior ethmoidal artery to the nasal cavity.
- Anterior ethmoidal artery to the nasal cavity.
- Internal palpebral artery.
- Dorsal nasal artery external nose.

✓ The lacrimal artery commonly anastomoses with the middle meningeal artery, via the foramen lacrimal and may be derived from it.

Innervation Of The Globe

i. **MOTOR NERVES:**
   1. The oculomotor n. (3rd cranial nerve) → medial, superior ,inferior recti muscles & the inferior oblique m.
   2. The trochlear n. (4th cranial nerve) → superior oblique m.
   3. The abducent n. (6th cranial nerve) → lateral rectus m.

ii. **SENSORY NERVES:**
   1. Optic nerve
   2. Ophthelmic nerve (1st branch of trigeminal n.) it divided
      a. Frontal n.
      b. Lacrimal n.
      c. Nasociliary n.:The long root of ciliary ganglion.
         - Long ciliary n.
         - Short ciliary n.

iii. **AUTONOMIC NERVES:**
   1. The sympathetic nerve, originate from the superior cervical ganglion in the cranial portion of the sympathetic chain . They form the sympathetic root of the ciliary ganglion & supply the smooth ms.
      - (Muller's ms. in the orbit , pupillary dilator ms in the globe & Muller's ms in the lid)→Horner's syndrome
   2. Parasympathetic nerves : reach the globe via the oculomotor n. ,they form the short oculomotor root of the ciliary ganglion & innervate the ciliary ms. of accommodation as well as the sphincter ms. of pupil.

Venous Drainage

A. **Retinal system :**

✓ The central retinal vein drains the inner layers of the retina "except the fovea".

✓ It ends in the cavernous sinus.

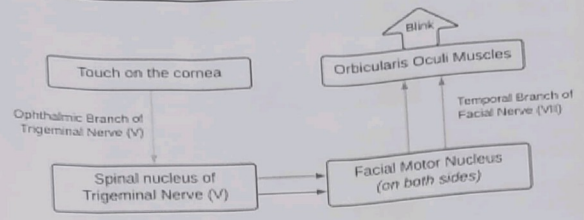
B. **Ciliary system:**

1. The ant. Ciliary veins (less important) drain only the ciliary m. They end in the muscular veins of recti .
2. The venae vorticosae (2 upper & 2 lower) pierce the sclera behind the equator . They drain all the uveal tract .
   - The upper 2→superior ophthalmic v. } cavernous
   - The lower 2→inferior ophthalmic v. } sinus.

OCULAR REFLEXES

Ocular reflexes

1- Corneal reflex (Blink reflex +/- tear reflex)


Blink
Touch on the cornea
Orbicularis Oculi Muscles
Ophthalmic Branch of Trigeminal Nerve (V)
Temporal Branch of Facial Nerve (VII)
Spinal nucleus of Trigeminal Nerve (V)
Facial Motor Nucleus (on both sides)

Afferent Ophthalmic Branch of Trigeminal Nerve (SENSORY)

Efferent Facial Nerve (MOTOR) + parasympathetic stimulation of lacrimal gland

Q: What increases corneal reflex?

A: Corneal or conjunctival irritation (Dryness, F.B, Infection,..etc)

Q: What decreases corneal reflex?

1- **Disorders affecting Trigeminal Nerve**

- Topical anesthesia, Recurrent Herpetic Keratitis, Chemical injuries
- Cerebellopontine angle tumors, Multiple Sclerosis, Brain stem stroke,etc…

⇓

Neurotrophic Corneal Ulcer

2- **Disorders affecting Facial Nerve (e. g. Bells palsy)**

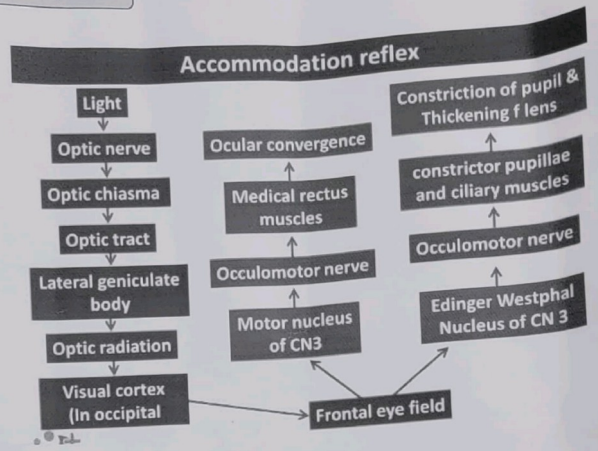
⇓

Exposure Keratitis

Treatment:

- Topical Antibiotic drops (until ulcer heals) e.g. Tobramycine eye drops 1*4
- Topical Lubricant drops (until reflex works again)
- Topical Antibiotic ointment at bed time e.g. Erythromycine eye ointment (with emphasis to clos
  eyelids with medical adhesive plaster at bed time in case of Exposure Keratitis)

2- Accommodation (Near) reflex



- **Components**

1- Convergence

2- Pupil constriction (miosis)

3- Accommodation :Increased lens thickening (increased lens power)

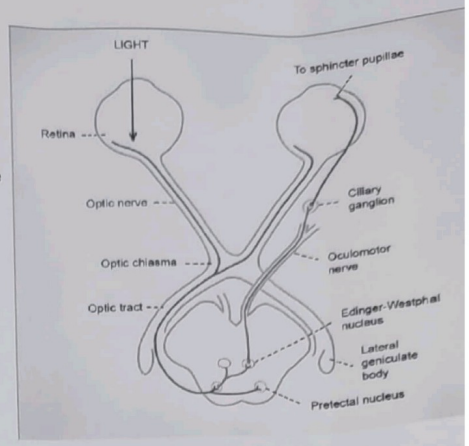
- **Disorders causing disturbance of accommodation**
  1. presbyopia ➡ the crystalline lens becomes less elastic and therefore it cannot increase its power in response to near objects
  2. Cycloplegic medriatic drops ➡ distruback of miosis and accommodation
  3. Midbrain lesions ➡ disturbance of convergence
  4. Adie's pupil ➡ disturbance of miosis and accommodation

3- Light reflex

- **Pathway**

Afferent ➡ optic nerve

Efferent ➡ Parasympathetic with the 3rd nerve



- **Types :**

1- *Direct light reflex* : constriction of the pupil of the same eye that you're shining the light at.

2- *Indirect light reflex (Consensual light reflex)*: constriction of the pupil of the right eye,for example while you're shining the light at the left eye.

- **Method**

Direct light reflex: *In a dim lighted room*, ask the patient to look forwards far away and then shine the light towards the left eye *from the side* (in order not to stimulate the accommodation reflex). Look at left eye's pupil(normally it should constrict).

Indirect light reflex: Repeat the above step, but this time look at the right eye's pupil while you shine the light at the left eye. The right eye's pupil normally should constrict as well.

- **Lesions**

1- If the optic nerve is damaged:

- ✓ **Amourotic pupil** (when the affected eye is stimulated by light, neither pupil will react), but when the normal other pupil is stimulated by light, both pupils react normally)
- ✓ **Argyll-Robertson pupil** (caused by neurosyphilis): damage to pretectal nucleus
- ✓ Both pupils are equal in size
- ✓ The near reflex is NORMAL

2- If the Parasympathetic nerve is damaged:

- ✓ In the affected side, the pupil is dilated and does not react to direct or indirect light reflex.
- ✓ The accommodation reflex is poor as well.

Light Reflex

When light fall on eye

Ipsilateral pupil constrict ➡ (Direct)

Other pupil constrict ➡ (Indirect, consensual)

Pathway

Stimulus ➡ Light

Receptor ➡ Rod & cones

Afferent ➡ Optic nerve, Optic chiasm,Optic tract

Center ➡ Edinger Westphal nucleus

Efferent ➡ 3rd cranial nerve ➡ ciliary ganglion ➡ sphincter pupillae ms

(Indirect, consensual) reflex as result of cross of fiber at
1- in optic chiasm (nasal fiber of optic nerve)
2- in mid brain (Edinger - Westphal nucleus)

The Near Reflex

When the eyes look at a near object, three responses occur

1. Accommodation
2. Convergence
3. Miosis

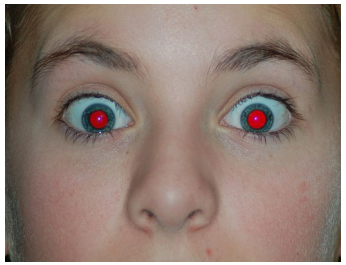
Angle of squint

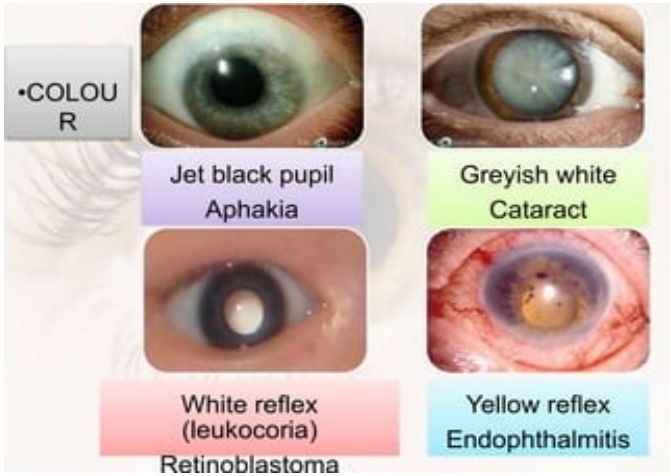
1- Corneal light reflex (Hirschberg test)
Put the torch in front both eyes at 50cm & ask the patient to fix on torch & observe reflex of light on surface of cornea of both eyes
*If both light reflex are on the centre of both corneas so there is **NO SQUINT**
* If light reflex of one cornea is central while the light reflex of other cornea is **NOT** central so there is **SQUINT**

Corneal light reflex help us to know ANGLE OF SQUINT
IF at Pupil margin = 15º
IF between pupil margin &limbus =30º
IF at limbus =45º

The red reflex :

1. Greyish white : in mature cataract
2. Black :vitreous hemorrhage & black cataract
3. Grey : RD
4. Yellow : glioma retinae , pseudoglioma , pus in vitreous (e.g. pano/endophthalmitis)
5. White : (leukocorea)
6. Opacities on a red background in immature cataract & in vitreous opacities





Summary of abnormal reactions of constrictor reflexes.

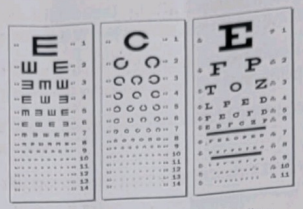
visual acuity
- Normal → Adie's tonic pupil / Argyll Roberston pupil.
- Impaired → Marcus Gunn pupil
- Lost (NLP) → Amaurotic pupil.

visual reflex (in affected eye)
- React slowly → Marcus Gunn pupil
- Not react but react to accommodation → Argyll R.pupil.
- Not react for both light & accommodation or very slow tonic → Adie's tonic pupil

Eye Tests

ABDLWHB QUSHAISH

1-Visual acuity (VA) is a measure of the ability of the eye to distinguish shapes and the details of objects at a given distance



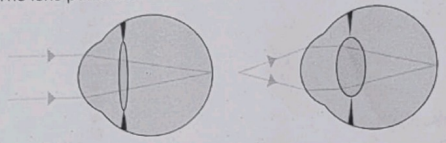
Illetrate E Landolts C Snellen

Why is visual acuity done at 6 meters?

- At this distance, the rays are almost parallel, and the patient usually does not accommodate to see at this distance

What is the meaning of "Accommodation"?

- It is the mechanism by which the eye changes refractive power by altering the shape of its crystalline lens.
- The ciliary muscle contracts ➡ The zonular fibers relax ➡ The lens becomes more MORE CONVEX ➡ The lens power increases



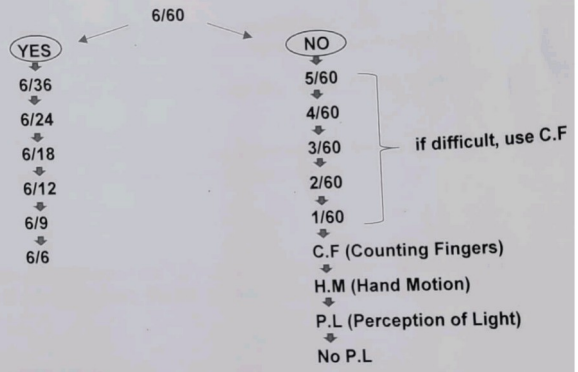
How to measure VA?

- Ask the patient to cover one eye with a plain occluder, card or tissue. They should not press on the eye; this is not good for an eye that has undergone surgery. It can also make any subsequent intraocular pressure reading inaccurate and it will distort vision when the occluded eye is tested.
- Ask the patient to read from the top of the chart and from left to right. If the patient cannot read the letters due to language difficulties, use an E chart. The patient is asked to point in the direction the 'legs' of the E are facing.

- Record the VA for each eye in the patient's notes, stating whether it is with or without correction (spectacles). For example: **Right VA = 6/18 with correction, Left VA= 6/24 with correction.**
- If the patient cannot read the largest (top) letter at 6 meters, move him/her closer, 1 meter at a time, until the top letter can be seen – the VA will then be recorded as 5/60 or 4/60, etc.
- If the top letter cannot be read at 1 meter (1/60), hold up your fingers at varying distances of less than 1 meter and check whether the patient can count them. This is recorded as counting fingers (CF): **VA = CF**
- If the patient cannot count fingers, wave your hand and check if he/she can see this. This is recorded as hand movements (HM): **VA = HM**
- If the patient cannot see hand movements, shine a torch toward the eye and ask if they can see the light. If they can, record 'perception of light' (**VA = PL**). If they cannot, record 'no perception of light' (**VA = NPL**).

The **top number refers to the distance where the patient stands from the chart**. In most cases, this will be 6 meters. **The bottom number refers to the distance at which an average person with normal eyesight could read the same line that the patient reads**.

For example, 6/6 is considered normal. 6/12 indicates that the line which the patient reads correctly could be read by a person with normal vision from 12 meters away.



- **Visual acuity**; is the ability to appreciate the form of the smallest retinal image and is measured by the smallest object which can be seen at a certain distance.
- **Principle of tests of vision** : it depends on the minimal visual angle which is the smallest angle (normally = 1 minute), subtended at the nodal point of the eye by two small points in order to see separate, when the 2 points stimulate 2 cones in the macula with a non stimulated cone in-between
- **Test charts for distant visual acuity:**

1- **Landolt's chart test** (broken ring)
Consists of 7 lines of broken rings, the uppermost is the largest and should be seen by a normal eye at a distance of 6 meters(20 feet),The next lines at a distance of 36, 24, 18, 12, and 6 meters respectively.
Method :; the patient is seated at a distance of 6 meters from the chart, and the possible smallest line seen by him should be found out. Right eye is tested separately with left eye covered and then the left one.
Result; if the patient sees the smallest line → his visual acuity is recorded as 6/6. If the patient only sees the 2nd line from below → it is 6/9 and so on 6/12, 6/18, 6/24, 6/36, 6/60.

2- **Snellen's chart test** (letter types); it is used to educated people only.

- ❖ 6/18 vision means that the eye can see at distance of 6 m what normal eye can see at 18 m.
- ❖ Distant visual acuity is improved with the pin-hole test if the reduced vision is due to a refractive error (unlike ocular disease or amblyopia)
- ❖ If the visual acuity is less than 1/60;-

Name	Abbreviation	Definition
Counting fingers	CF	The distance at which fingers can be counted is recorded (at 90cm, 80cm…till 10cm)
Hand motion	HM	Ability to distinguish a hand if it is moving or not in front of the patient' face
Light perception	LP	Ability to distinguish if the eye can perceive any light
No light perception	NLP	Inability to see any light. Total blindness

- **Test cards for near vision:**
Near vision is tested by special cards with regarded sizes of letters or written words. The smallest type the patient can read at a distance at which he is accustomed to read ,or to perform near work, is measure of his near vision.
- **Tests of visual acuity in children:**
The type of test of visual acuity depends on the age of the child
  - In children less than 2 years, visual acuity can be assessed by:
    1) A Catford drum 2) Acuity cards 3) Preferential looking
  - In children older than 3 years who are still illiterate, visual acuity tests consist of :
    1) Matching either a letter or a symbol such as STYCAR letters, E test and Sheridan-Gardiner test
    2) Naming the pictures on a chart such as the Kay pictures.

➢ Examination of visual field:

- **Visual field**: area in space seen at one time by one eye (uniocular field), or both eyes (binocular field)
- **Value**: detection of the function of the periphery of the retina and visual pathway.
- **Testing the field of vision:**

1- **Confrontation test** (rough test):
- The examiner sits at a distance of 60 cm from the patient
- The patient is told to look straight into examiner's left eye
- The patient left eye is covered and the examiner's right eye is closed to compare the right field of the patient with the left field of the examiner and vice versa
- The examiner moves his finger from above, below, right and left sides keeping his hand in plane half-way between the patient and himself to compare his field of vision with that of the patient
- If the patient sees the moving finger as soon as the examiner sees it, his field of vision is normal (supposed that the examiner has a normal field).

2- **Perimetry**

3- **Campimetry (scotometry)**: examination of the central field of vision

4- **Projection of light**: it is done if the patient cannot see the central fixation mark of the perimeter at a distance of 33cm (as in mature cataract), by using a small bead of dim light which is projected from the right, from the left, from above and from below while the other eye is covered.

Metric	Imperial (American) feet	Decimal
6/60	20/200	0.1
6/30	20/100	0.2
6/24	20/80	0.25
6/18	20/60	0.3
6/15	20/50	0.4
6/12	20/40	0.5
6/9	20/30	0.6
6/7.5	20/25	0.8
6/6	20/20	1.0

N.B: 1 meter = 3.3 feet (so 6 meters × 3.3 = 20 Feet)

Refraction

- It is done using 1 -Autorefractometer
  Or 2- Retinoscope (usually used for young children)

N.B: In Children, cycloplegic refraction (refraction after using cycloplegic drops e.g. Tropicomide, Cyclopentolate, Atropine) is usually needed to get the correct refraction because children have strong accommodative power.

- The result could be any of the following:
  1- Emmetropia (NO refractive errors)
  2- Myopia
  3- Hypermetropia
  4- Astigmatism: Types 1- Simple (Myopic, Hyperopic) Astigmatism
  2- Compound (Myopic, Hyperopic) Astigmatism
  3- Mixed Astigmatism
- Anisometropia: means asymmetric refraction between both eyes (MORE than 1 DIOPTER in spherical equivalent)
- *Note: Spherical equivalent = ½ Cylinder + Sphere*
- If the patient does NOT improve with glasses, then you must look for the cause!!(e.g., cornea, anterior chamber, lens, vitreous, retina, optic nerve, visual pathway)

2-Pinhole test

A pinhole occluder (an opaque disc with one hole 1.2 mm) is used to determine whether reduced vision is caused by refractive error. If this is the case, the pinhole will cause an improvement in visual acuity.

3- Color vision test

- **Ishihara test** is most commonly used
- Types of color blindness

1. ***Protanopia*** : inability to see RED color
2. ***Deuteranopia***: inability to see GREEN color
3. ***Tritanopia***: inability to see BLUE color
4. ***Achromatopsia***: inability to see ALL colors

Eye charts for testing visual acuity at a distance of 6 meters

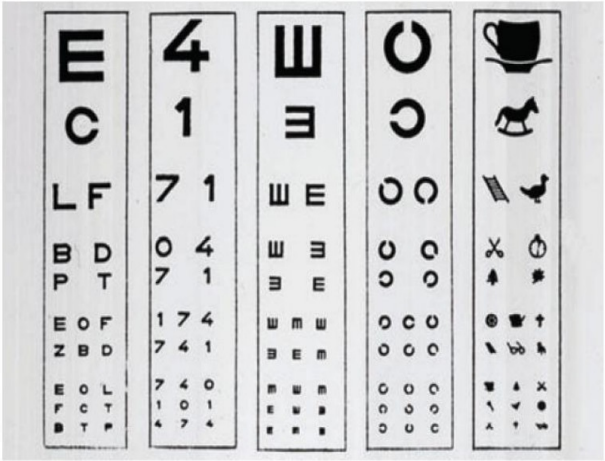
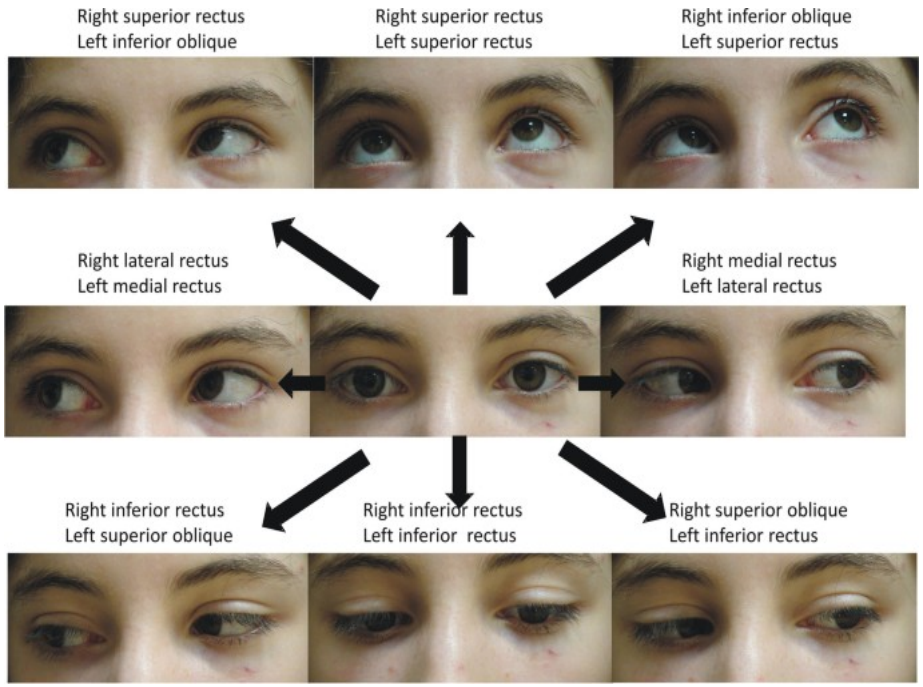


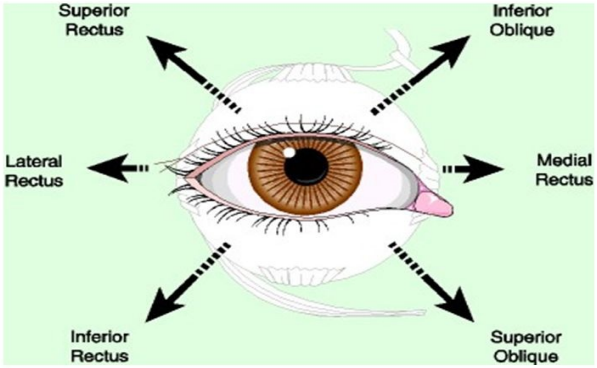
Fig. 1.2 *From left to right:* Snellen letter chart, Arabic number chart, E game, Landolt broken rings, and a children's pictograph.

Ocular Motility Test



Total Gaze

MUSCLE TESTING: CARDINAL POSITIONS



Worth Four-Dot Test

- a gross test which provides information only about the status of peripheral binocular cooperation
- Harmonious ARC= 4 lights (Deviation)
- 2 lights (Left suppression)
- 3 lights (right suppression
- 5 lights (Diplopia)

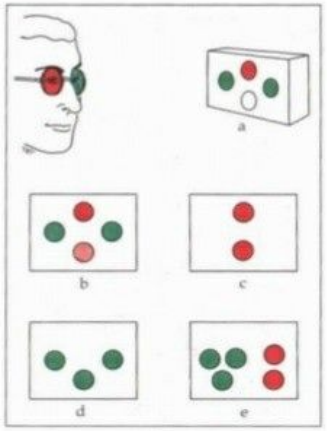
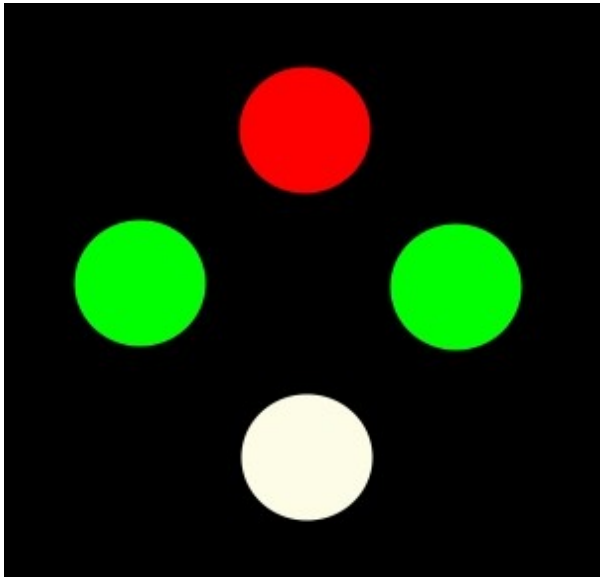
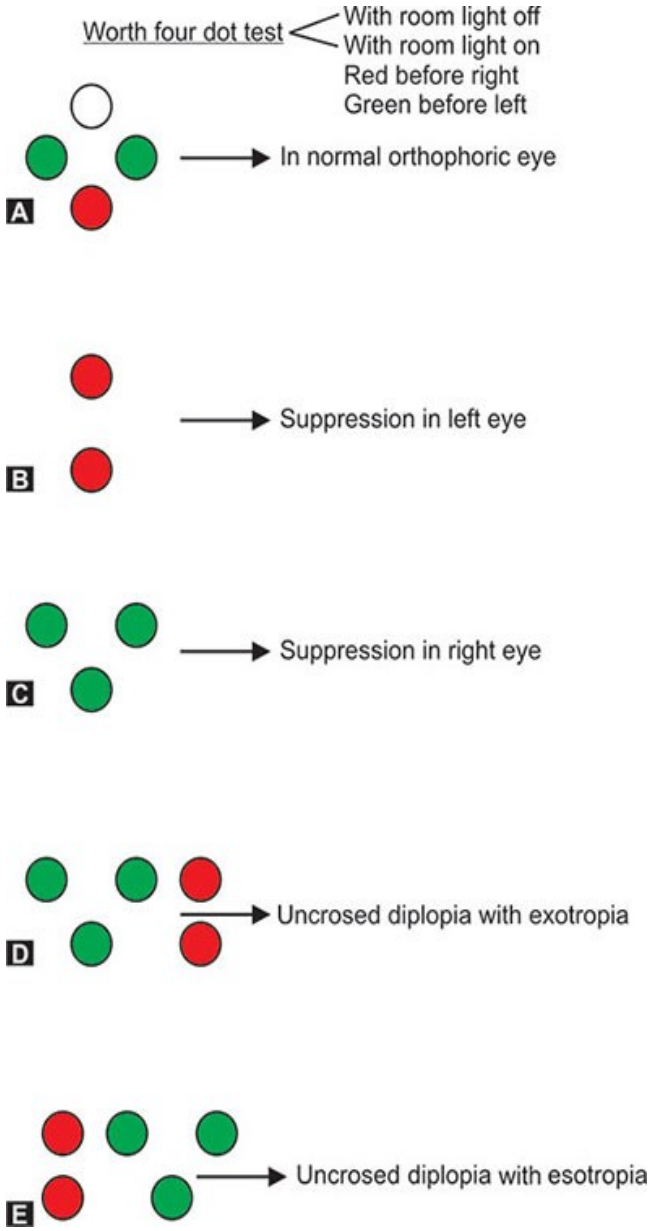


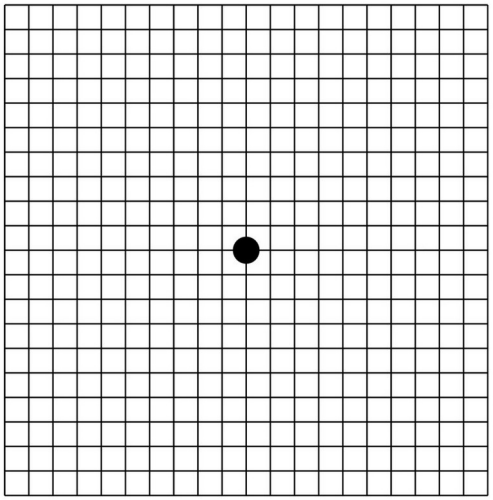
Figure 13.14 Worth four-dot test (see text)

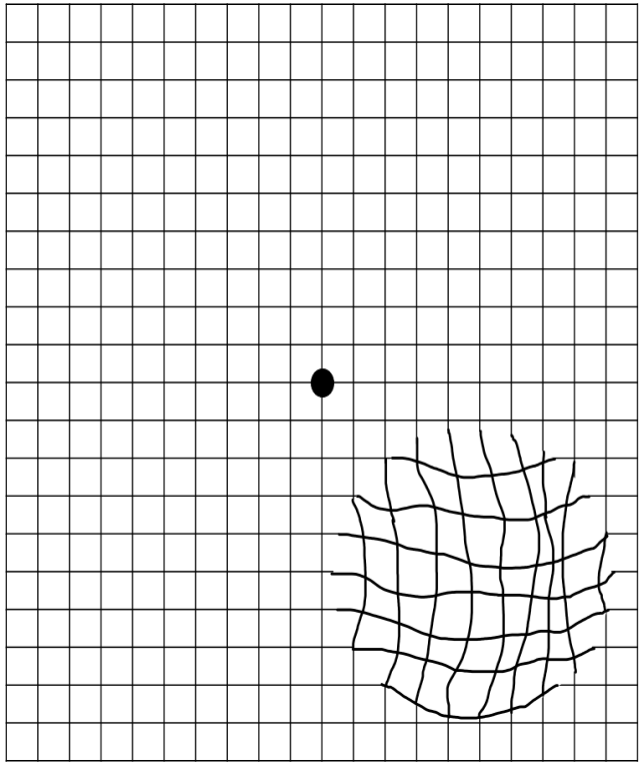




ABDLWHB QUSHAISH

Check your vision daily with the Amsler grid



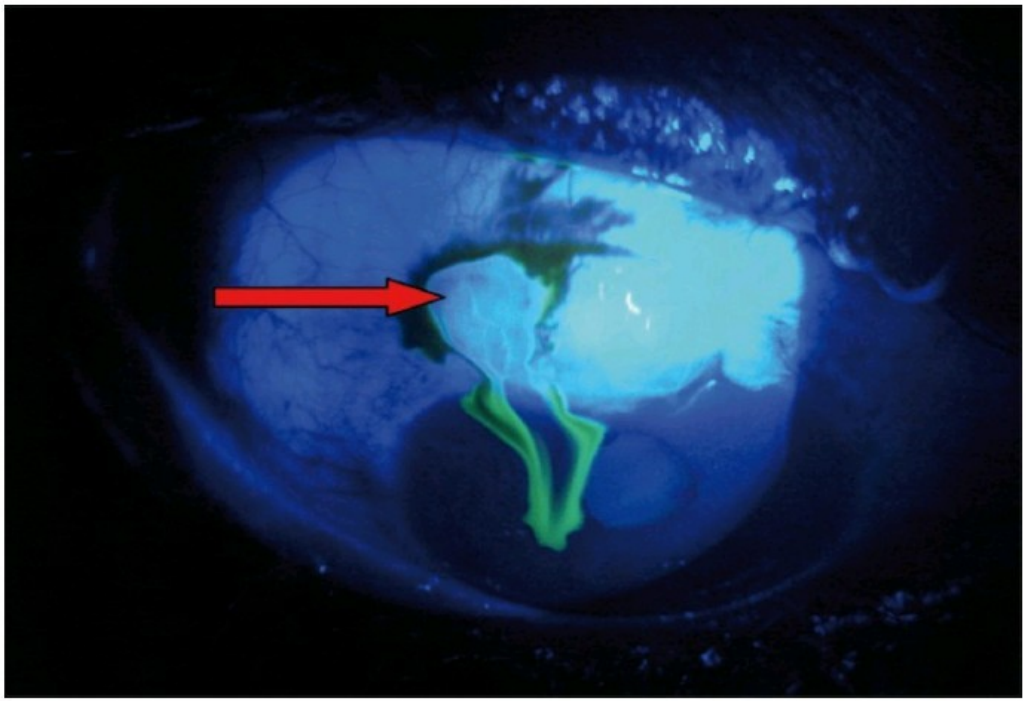


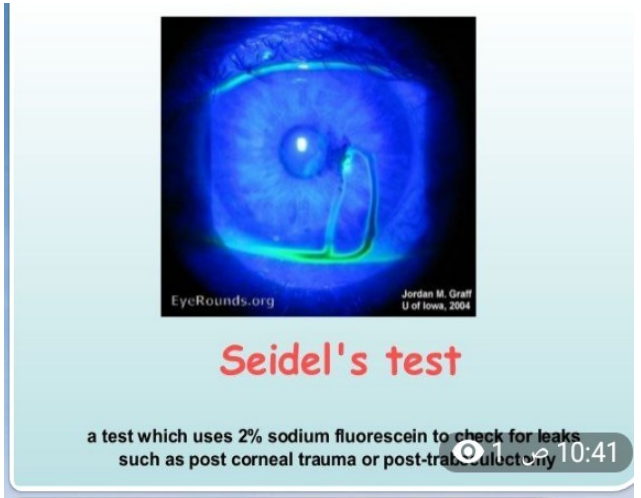
Instructions for using the Amsler grid:

1. Make sure you are in an area with good lighting. Post the chart at eye level and at a comfortable distance (about 12-14 inches away) - you may want to stick the chart to a wall. If the grid lines appear doubled, try adjusting your distance.
2. Wear your reading glasses (if you wear bifocals, use the bottom portion of the lens), and be sure to cover the other eye with your hand - as your healthy eye can make up for vision loss in your other eye.
3. Focus on the centre dot for about 10 seconds.
4. While looking directly at the centre, be sure that all the lines are straight and clear, and all the small squares are the same size. Repeat the test in the other eye.
5. If any lines or squares appear distorted, wavy, blurred or dark - call your eye doctor immediately.

Seidel test

this technique is used to identify leakage of aqueous from the anterior chamber. Its use is essential in the clinical evaluation of both traumatic and post-operative corneal wounds.




EyeRounds.org
Jordan M. Graff
U of Iowa, 2004
Seidel's test
a test which uses 2% sodium fluorescein to check for leaks
such as post corneal trauma or post-trab
10:41

The Seidel Test is used to assess the presence of anterior chamber leakage in the cornea. It is used as a screening test for many corneal disorders including corneal post-trauma, corneal perforation and corneal degeneration.

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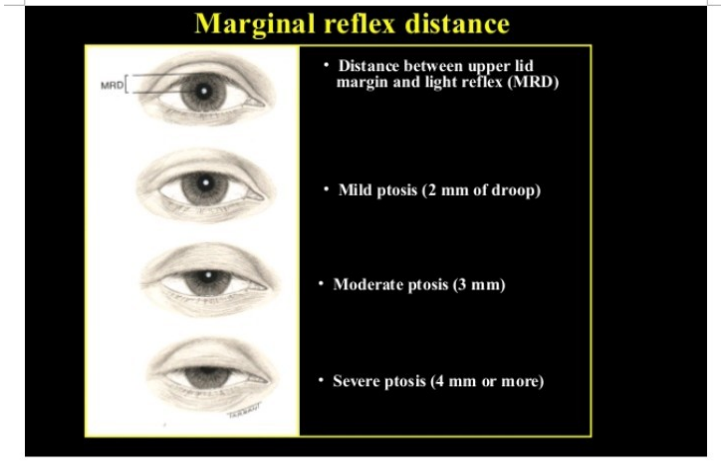
exophthalmometer

an instrument used for measuring the degree of forward displacement of the eye in exophthalmos. The device allows measurement of the forward distance of the lateral orbital rim to the front of the cornea

Marginal reflex distance

Measurement of ptosis

The Margin Reflex Distance is the vertical distance between the pupillary light reflex and the eyelid margin. If less than 4mm …….ptosis


Marginal reflex distance
MRD
• Distance between upper lid margin and light reflex (MRD)
• Mild ptosis (2 mm of droop)
• Moderate ptosis (3 mm)
• Severe ptosis (4 mm or more)

Tear break up time

Used in dry eye

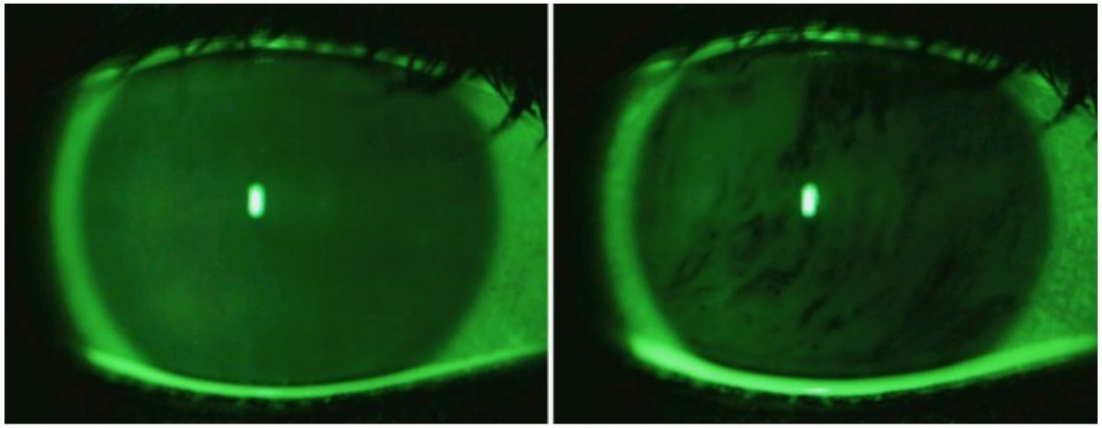
This is test for the stability of the tear film

Instill fluorescein, ask patient to blink several time &then stop

TBUT is the time from last blink to development of dry spot in fluorescein film

Normal range 15_35second

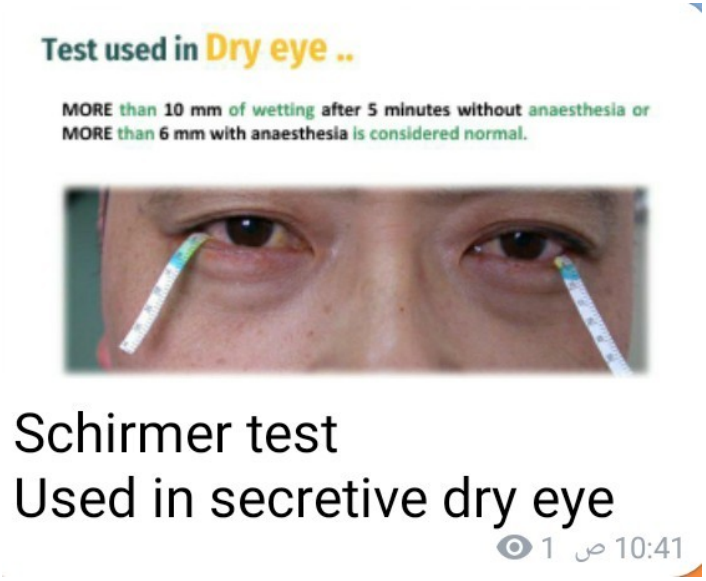
Diminish less than 10second



0:24
٨٫٨ MB
1- Tear break up time
TBUT ((This is test for the stability of the tear film))
-instill fluorescein into the lower fornix, ask patient to blink (Less Than 10 Second) indicate impaired of secretion.
1 ص 10:41

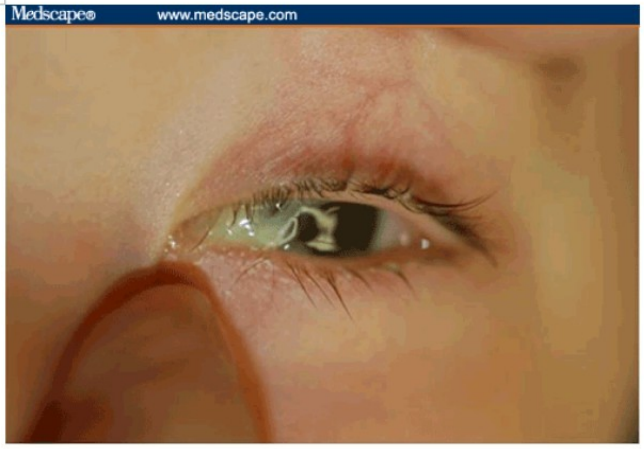
Schirmer test

Measuring the amount of lacrimal gland secretion by measuring the wetting of filter paper
10_15mm is normal
Less than 6mm indicate impaired in secretion


Test used in Dry eye ..
MORE than 10 mm of wetting after 5 minutes without anaesthesia or
MORE than 6 mm with anaesthesia is considered normal.
Schirmer test
Used in secretive dry eye
1 ص 10:41

Regurgitation test
Used in watery eye
Press on the lacrimal sac

+ve regure: reflux of pus or tear from puncti……indicate NLD obstruction
_ve regure: no reflex…..patent lacrimal passage



Jones test:
Used in watery eye
Type 1
Instill a drop of fluorescin & insert a cotton swab under inferior meatus

If the cotton stained with fluorescin….patent passage

Not stained…..obstruction

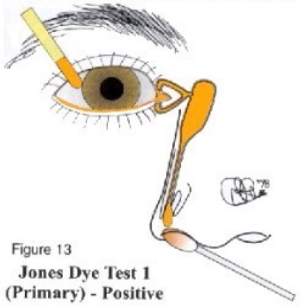


Figure 13
Jones Dye Test 1 (Primary) - Positive

Type 2
After type 1 irrigate the lacrimal passage with saline

If fluorescin is recovered….there is partial obstruction
If fluor. Is not recovered…..complete obstruction

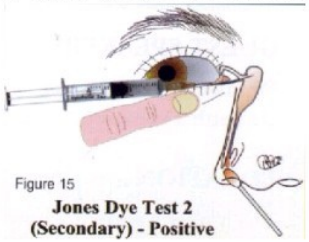
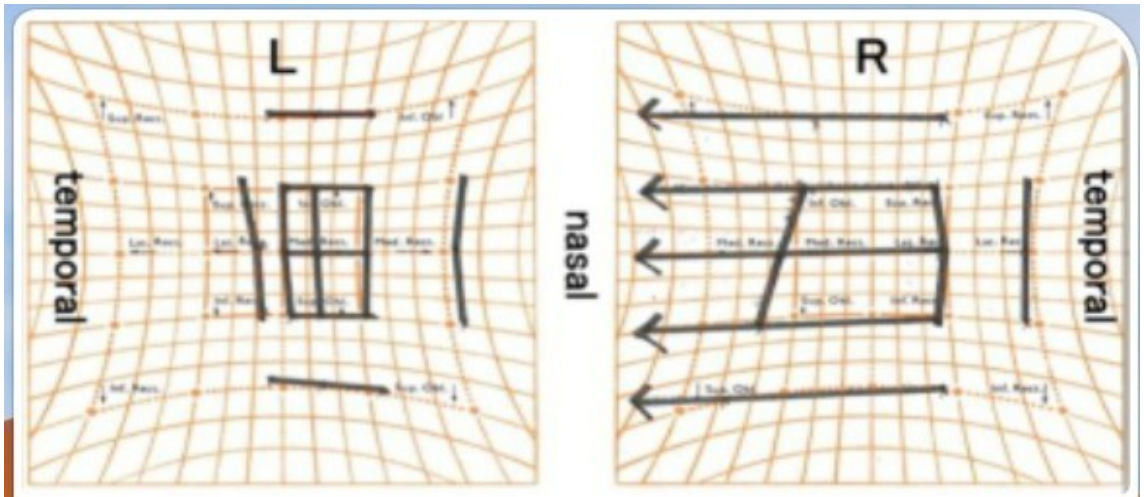


Figure 15
Jones Dye Test 2 (Secondary) - Positive



Hess test ✔✔✔v.imp

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ال investigation ل 👇

blow out fracture

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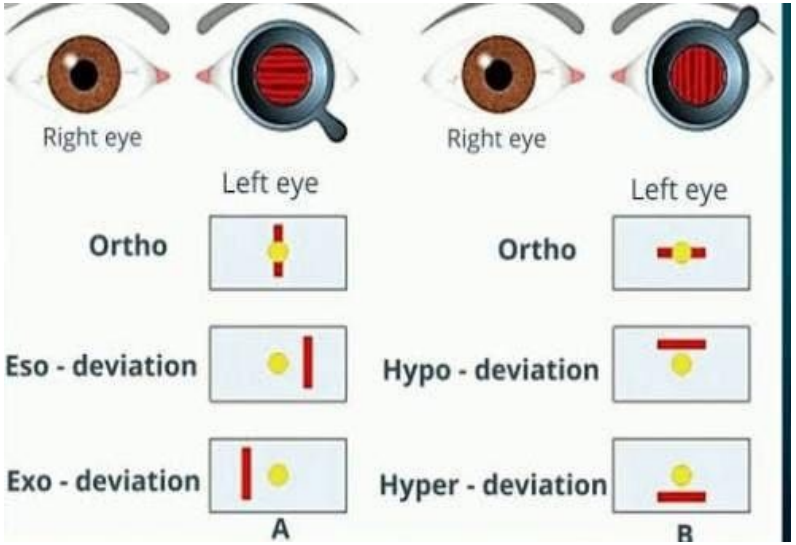
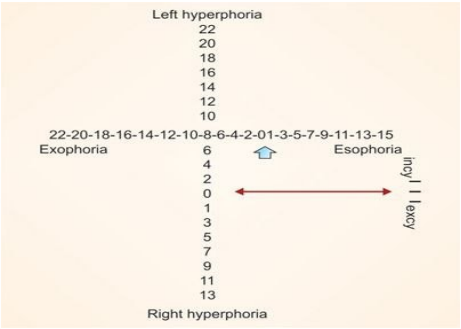




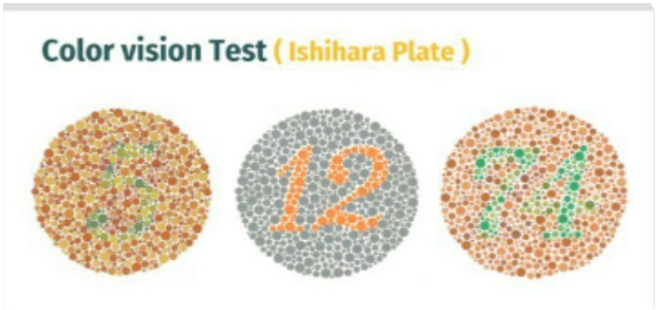
Maddox Rod Test

Maddox Wing Test

Uses of Maddox Rod

Maddox rod is used in the diagnosis of extra ocular muscle imbalance.

- Maddox rod is placed in front of right eye.
- A distance white spot light source viewed through both eye
- Right eyes see red line at 90^0 to the axis of Maddox rod, left eyes sees spotlight.
- Two eyes sees dissimilar images and dissociated, allowing any muscle imbalance to become manifest.



Uses in color test
It's screening not diagnostic

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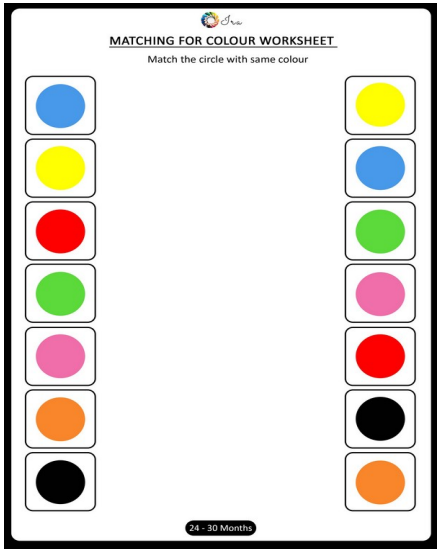
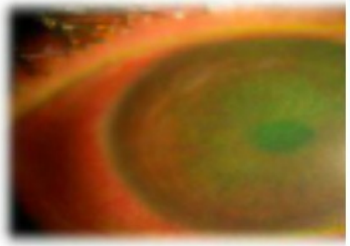


- **Examination of color vision:**
  - **Importance:** testing for color vision gives an idea about the macula in mature cataract and is important in certain occupations as in drivers.
  - **Testing for color vision:**
    1) Ishihara test 2) Color matching test 3) Colored glass discs

- **Examination of the state of refraction:**
  1) **Retinoscopy**: it is an objective method for estimation of the refraction of the eye
  2) **Keratometer**: it measures the corneal astigmatism (radius of curvature and refractive power)
  3) **Autorefractometer**: it measures the refractive state of the eye and fives full data about the refractive problems
  4) **Checking methods**: these methods are used to check the accuracy of the prescribed lenses: (Astigmatic fan, Cross cylinder, Placido's disc or electric keratoscope, and Pin-hole test)

  Pin-hole test: it improves the reduced visual acuity in refractive error up to 6/9. But it cannot improve the reduced visual acuity in ocular and neurological diseases or in amblyopia.

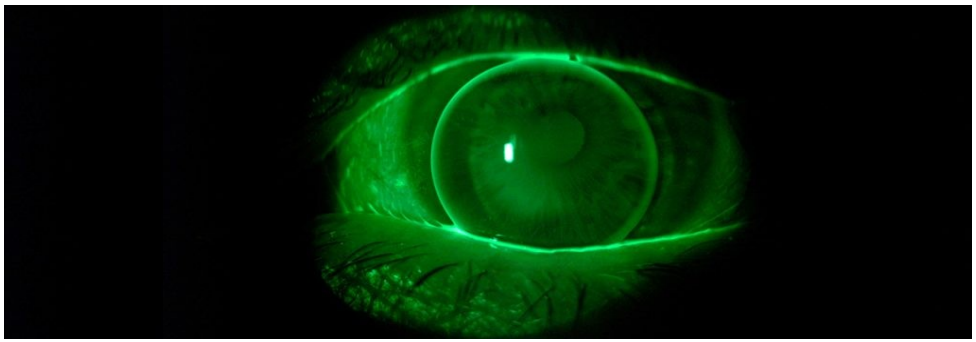
- **Important clinical notes :-**
  1- eye drops ē **yellow cap** is → Nivosin (local anesthesia .
  2- eye drops ē **red cap** is → Mydriacyl (Mydriatics).
  3- eye drops ē **green cap** is → Pilocarpin (Miotics) .

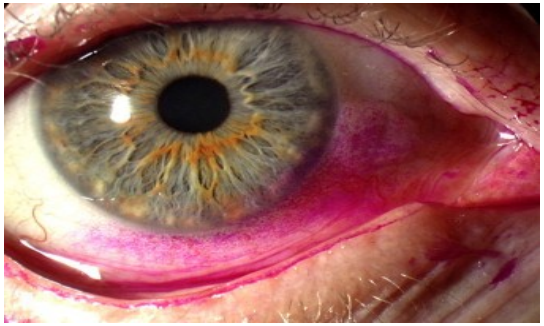


Uses:
Stain corneal lesions
Dry eye
With Tonometer
Tear break up time
Jones dye test
Seidle test

1 ص 10:41

- **Eye Stains** :
  - **I- Uses of fluorescein in ophthalmology** :→dead/defected epithelium.
    1. Intra-ocular pressure measurement (with Goldman applanation tonometer)
    2. To determine the state of continuity of the corneal epithelium
       a. corneal ulcer
       b. corneal fistula
       c. corneal punctuate
    3. Fluorescein test for epiphora (Jones dye test)
    4. Fitting of contact lenses (except with soft contact lens)
    5. Fluorescein angiography : it is a method of fundus examination in which many photographs of the fundus are taken in secession
       a. diagnosis of macular disease (degeneration / oedema)
       b. diagnosis of vascular retinopathy (e.g. diabetic retinopathy)
       c. diagnosis of fundus tumors .
    6. Tear film break-up time (for ass. of dry eye & DE $). Fluorescein is insilled into the lower fornix & the p.t is asked to blink several times then stop →after the last blink the tear film is broken up & dry spots appears. the tear film break up time = the interval between the last blink & the appearance of the first dry spot . Normally ≥ 15 sec.
    7. Seidale's test (test wound leak) : to prove perforation of corneal ulcer & the presence of fistula or rupture of corneal descematocele . by testing the leakage of aqeous from cornea . "green river is seen coming out from the wound"
  - **II- Uses of Rose bengal stain** : →devitalized cells/ debris cells
    1. Assessment of dry eye $ (DE$) & dry eye
    2. Diagnosis of dendritic ulcer (i.e double stain)
    3. Punctuate keratitis





Instruments

1- Ophthalmoscope

1-Direct ophthalmoscope	2-Indirect ophthalmoscope
Erect image	Inverted image
Magnification X15	Magnification X5
Field smaller	Field large (Panoramic)
Illumination Not so bright	Illumination bright
Uniocular	Binocular
No Stereopsis (NO 3D)	Stereopsis (3D)

❖ Before examination:-

To allow for better inspection through the **pupil**, which **constricts** because of light from the ophthalmoscope, it is often desirable to **dilate** the pupil by application of a **mydriatic agent,** for instance **tropicamide.**

❖ Indications:-

1- Ophthalmoscopy is done as part of a routine eye examination.

2- It is used to detect

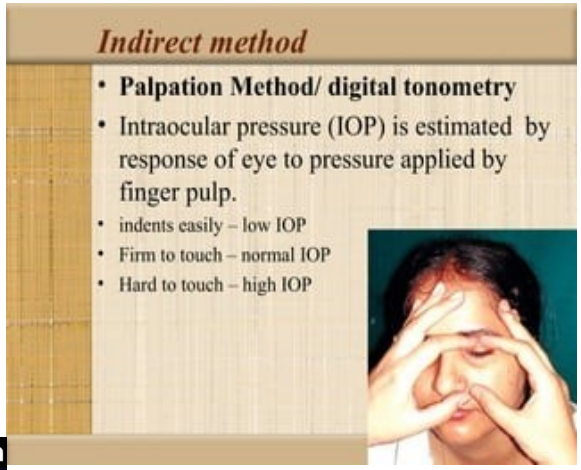
-retinal detachment

- glaucoma.

-swollen optic discs, or papilledema, on ophthalmoscopy

- In patients with diabetes mellitus, for diabetic retinopathy
- In patients with hypertension, for hypertensive retinopathy

2- Tonometry


Indirect method
Palpation Method/ digital tonometry
Intraocular pressure (IOP) is estimated by response of eye to pressure applied by finger pulp.
indents easily – low IOP
Firm to touch – normal IOP
Hard to touch – high IOP

1- Digital palpation (Digital tonometry) ((Rough test))

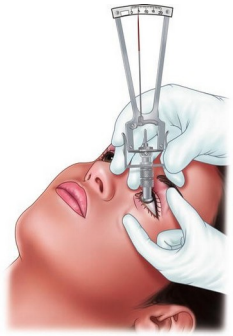
Value :- to test tension of sclera (rigidity)digitally
The patient is asked to look down, without closing his eyes; The eye is fluctuated between both index finger of examiner.

2- Tonometry

Tonometry is measurement of intraocular pressure.

A- Applanation Tonometry (Goldmann tonometer)

This is attached to the slit lamp and measures the force required to flatten a fixed area of the cornea. **(while patient is sitting)**
Disadvantage: -need local anesthesia ,fluorescin stain ,cross infection, expensive
Advantage: - more accurate



B- Indentation Tonometry (Schiotz Tonometry)
Is portable and measures the corneal indentation produced by a known weight.
(while patient is supine)
Disadvantage: - Schiotz is less accurate, Cross infection. Need local anesthesia
Advantage: - Cheap, easy to use, does not require slit lamp, Used when it is not possible to use the Applanation.

C- Tono-Pen Tonometry :- portable with contact

D-Air-puff Tonometry :- portable without contact (low risk of infection)

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3- Retinoscopy (skiaskopy)

is technique to obtain to measurement of the refractive error of a patient's eyes.

4- pachymeter

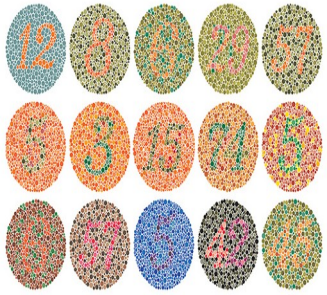
Corneal pachymetry is the process of measuring the thickness of the cornea.

It is used prior to LASIK surgery, for Keratoconus screening.

5- Ishihara Color Test

The **Ishihara Color Test** is color perception test for red-green color deficiencies.

The test consists of a number of colored plates, called **Ishihara plates**, each of which contains a circle of dots appearing randomized in color and size. Within the pattern are dots which form a number or shape clearly visible to those with normal color vision, and invisible, or difficult to see, to those with a red-green color vision defect,

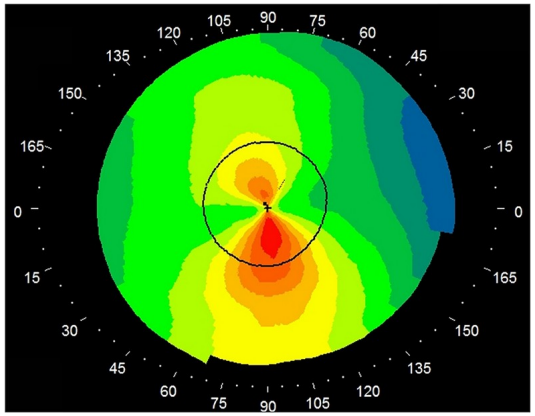


6- Specular Microscopy

non-invasive procedure used to monitor the number, and quality of endothelium cornea.

To screen for corneal diseases such as, keratoconus, trauma and other types of corneal dystrophies.

7- Corneal topography



Corneal topography, also known as **photokeratoscopy**

is a non-invasive medical imaging technique for mapping the surface curvature of the cornea

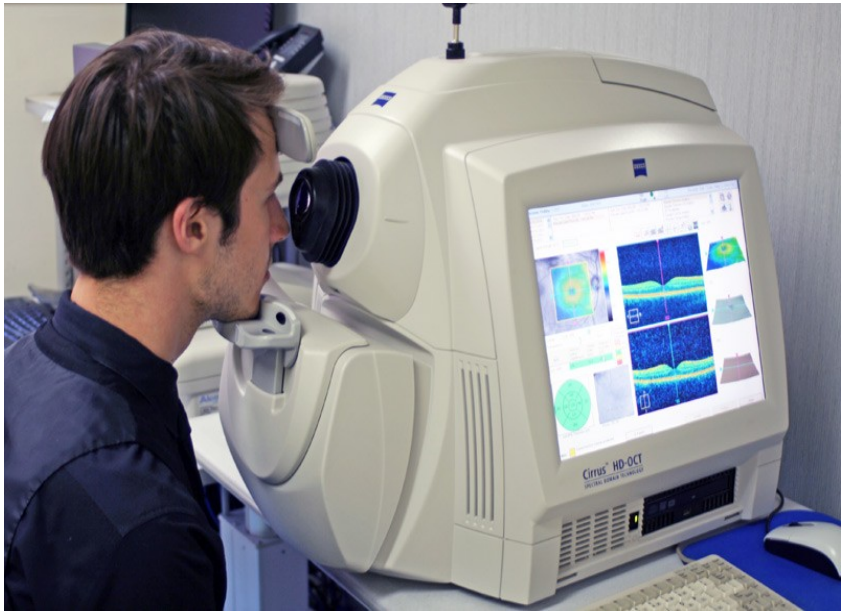
Corneal topography is most commonly **used** for the following purposes

1) Refractive surgery: To screen candidates and ruling out keratoconic patterns . Post operatively , topography can help to assess the post excimer ectasia

2) Keratoconus : Early screening of keratoconus

3) Post surgery astigmatism : Post cataract surgery and post keratoplasty corneal astigmatism can be studied with the topographer and selective suture removal or other interventions can be planned.

4) Effect of corneal and ocular surface disorders: Disorders such as pterygium , limbal dermoid , localised corneal scars can cause a change in the corneal topography and thus the monitoring is very useful.



8- Optical coherence tomography (OCT)

is a new, noninvasive, noncontact, transpupillary imaging retinal structures.

The appearance of a variety of posterior segment pathologies using OCT has been described. These include diabetic retinopathy, macular holes, epiretinal membranes, cystoid macular edema,

Uses

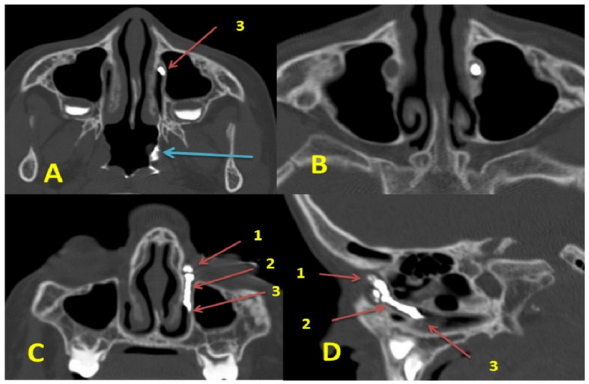
Retina

OCT is useful in the diagnosis of many retinal conditions, especially when the media is clear. In general, lesions in the macula are easier to image than lesions in the mid and far periphery. OCT can be particularly helpful in diagnosing:

- macular hole
- vitreomacular traction
- macular edema
- detachments of the neurosensory retina and retinal pigment epithelium (e.g. central serous retinopathy or age-related macular degeneration)

Optic neuropathies

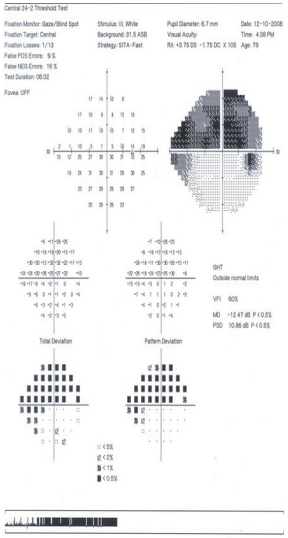
OCT is gaining increasing popularity when evaluating optic nerve disorders such as glaucoma. OCT can accurately and reproducibly evaluate the nerve fiber layer thickness.



9- Dacryocystography

An x ray of the tear duct after injection of a dye that is used to help locate a blockage in the duct.

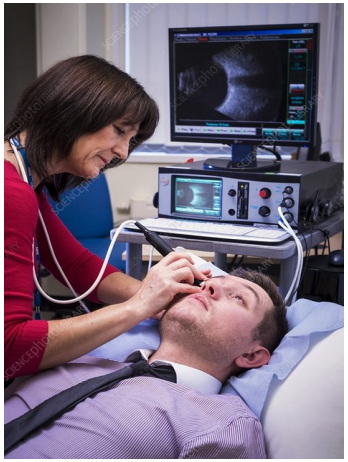
10- Perimetry



Perimetry is the systematic measurement of visual field function (the total area where objects can be seen in the peripheral vision while the eye is focused on a central point). The two most commonly used types of perimetry are **Goldmann** kinetic perimetry and threshold **static** automated perimetry.

A visual field test (perimetry) will detect loss of peripheral vision and provide a map of that loss which will be helpful in diagnosing the cause of the loss.

11- Ultrasonography



B-scan ultrasound is most useful when direct visualization of intraocular structures is difficult or impossible. Situations that prevent normal examination include lid problems (eg, severe edema, partial or total tarsorrhaphy), , corneal opacities (eg, scars, severe edema), hyphema, hypopyon, miosis, , dense cataracts, or vitreous opacities (eg, hemorrhage, inflammatory debris).[1]

In such cases, diagnostic B-scan ultrasound can accurately image intraocular structures and give valuable information on the status of the lens, vitreous, retina, choroid, and sclera. However, in many instances, ultrasound is used for diagnostic purposes even though pathology is clinically visible. Such instances include differentiating iris or ciliary body lesions; ruling out ciliary body detachments; and differentiating intraocular tumors, choroidal detachments, retinal detachments, and papilledema.

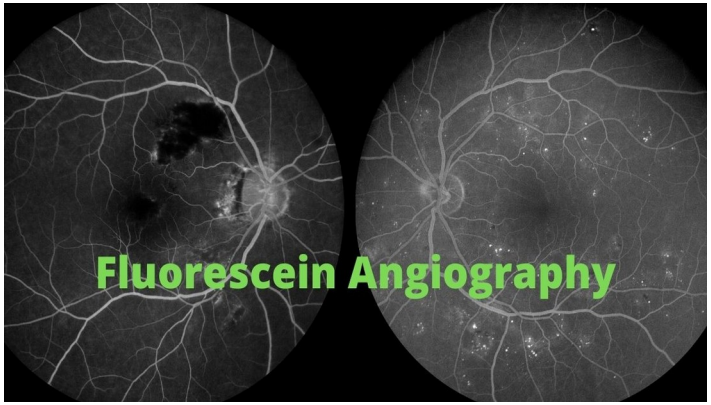
A-scan, is routine type of diagnostic test used in ophthalmology. The A-scan provides data on the length of the eye, which is a major determinant in common sight disorders.

The most common use of the A-scan is to determine eye length for calculation of intraocular lens power. The other major use of the A-scan is to determine the size and ultrasound characteristics of masses in the eye,

12- Fluorescein angiography

Intravenous Fluorescein angiography (IVFA) or **fluorescent angiography** is a technique for examining the circulation of the retina and choroid using a fluorescent dye and a specialized camera.

The fluorescein dye also reappears in the patient urine, causing the urine to appear darker, and sometimes orange.[2] It can also cause discolouration of the saliva.



13- keratometer

A keratometer is a medical instrument that eye care professionals use to measure the curvature and reflection of the anterior surface of the cornea. Also sometimes called an *ophthalmometer* , this device is primarily used to diagnose the presence of astigmatism, and to determine its degree and how it can be treated. Astigmatism is a condition of the eye in which the cornea or lens is misshapen and can result in vision problems.

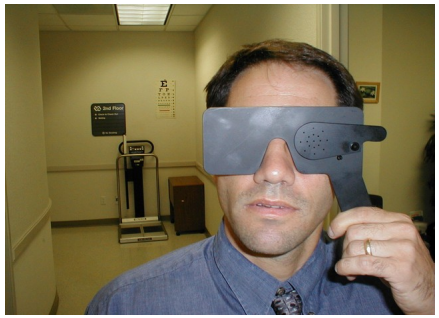
14- pinhole

A **pinhole occluder** is an opaque disk with one or more small holes through it, used by ophthalmologists to test visual acuity. The occluder is a simple way to focus light, temporarily removing the effects of refractive errors such as myopia. Because light passes only through the center of the eye's lens, defects in the shape of the lens (errors of refraction) have no effect while the occluder is used.

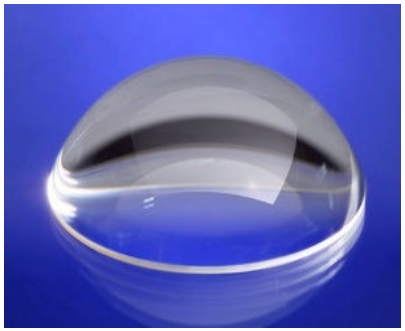
In this way the ophthalmologist can estimate the maximum improvement in a patient's vision that can be attained by lenses to correct errors of refraction.[1] This can be used to distinguish visual defects caused by refractive error, which improve when the occluder is used, from other problems, which do not.

Differential diagnosis :

- pinhole improves vision: refractive error, peripheral cataract
- pinhole worsen vision: Macular diseases,[4] central lens opacities[5]



15- spherical lens



Convex lens (plus) (convergent)	Concave lens (minus) (divergent)
Thick at center more than peripheral	Thick at peripheral more than center
Objects appear larger	Objects appear small
Objects looked at move in opposite direction to movement of the lens	Objects looked at move in same direction to movement of the lens

16- Schirmer's test

determines whether the eye produces enough tears to keep it moist. This test is used when a person experiences very dry eyes or excessive watering of the eyes. It poses no risk to the subject. A negative (more than 10 mm of moisture on the filter paper in 5 minutes) test result is normal. Both eyes normally secrete the same amount of tears.

17- Hertel Exophthalmometer

is an instrument used for measuring the degree of forward displacement of the eye inexophthalmos. The device allows measurement of the forward distance of the lateral orbital rim to the front of the cornea.[1] Exophthalmometers can also identify enophthalmos (retraction of the eye into the orbit), a sign of blow-out fracture or certain neoplasms.

18- goniolens

Uses of Goniolens::-

1- Examination of angle of A/C
2- Goniotomy
3- Laser trabeculoplasty
4- Fundus examination

A phoropter is an instrument used **to test individual lenses on each eye during an exam**. If, during an eye examination, your doctor has discovered a vision problem like nearsightedness, farsightedness or astigmatism, it's likely that one of the next steps you'll take will involve a phoropter.

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SURGICAL INSTRUMENTS

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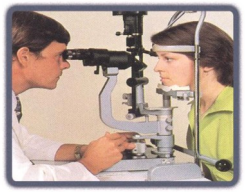
Examination of eye


slitlamp

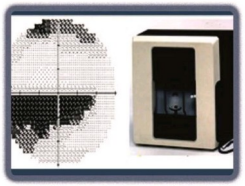
Lensemeter

keratometer

Lens trail case

trial frame

surgical loop


Visual field exam by humphrey perimetry

visual acuity test in verbal children

visula auity test by snellen's chart

indirict ophthalmoscopy

red reflex by dirict ophthlmoscopy

goldmann trible mirror

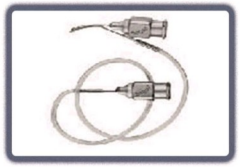
goldmann goniolens

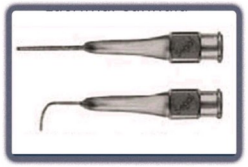
Surgical instruments

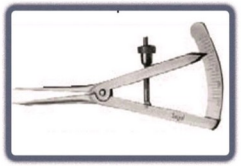
artery fosrcep

strabismus scissors

DCR punch


irrigation/aspiration cannula

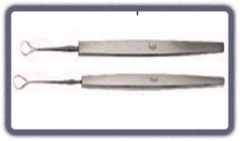

lacrimal cannula


calipre

lid retractor

lacrimal retractor

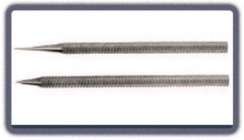
strabismus Ms hook

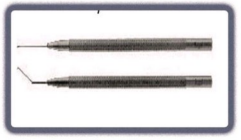

lens scoops

chalazion forceps

chalazion scoop

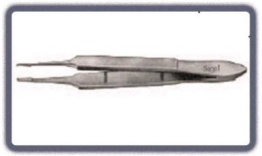
blade holder


lacrimal dilator


IOL dialer

Surgical instruments

tooth corneal forceps


St martin tooth forceps

curved colibri forceps

Tying forceps

capsule forceps

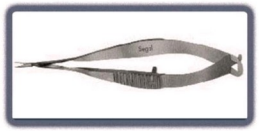
capsulorrhexis forceps

enucleation scissors

conjunctival & corneal scissors

curved corneal scissors

iris scissors


vannas scissor

needle holder

IOL insertor

IOL forceps

Iris repositor